MOORE INDUSTRIES

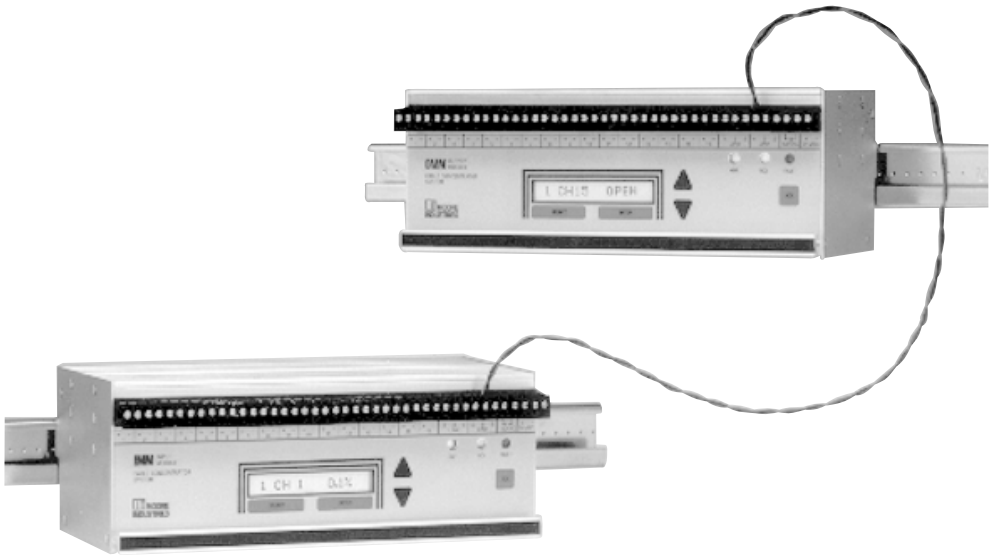
May 1996
280-701-00 F

16-Channel
Cable Concentrator System®

CCS®

Caution: This manual is intended for use with CCS modules having a serial number of 707795 and above, or units upgraded by Moore Industries to accommodate Version 1.7 or later of the CCS firmware or CCS units with version 1.0 of the Modbus firmware.

Do not **use this manual with older, or non-upgraded CCS modules**



CCS® *16-Channel Cable Concentrator System®*

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Introduction

Moore Industries' Cable Concentrator System®, the CCS®, is an easy-to-use, highly cost-effective group of devices used to "concentrate" and transmit multiple process instrumentation signals from point to point.

According to the requirements of your application, the System may be configured to use a single twisted wire pair, modems, or fiber optics to link its communications modules. This provides significant cost, maintenance, and space savings over bulky, conventional multi-conductor cabling.

This manual contains the information necessary to set jumpers, set system operating parameters, install, operate, maintain, and troubleshoot the CCS. It includes a brief unit description, a table of performance and operational specifications, and an explanation of Moore Industries' model number-based product data tracking system.

The following guidelines are used throughout the manual:

Warning – Hazardous procedure or condition that could injure or be fatal to the operator.

Caution – Hazardous procedure or condition that could damage or destroy the unit.

Note – Information that is essential for a procedure, condition, or operation of the unit.

Naming Conventions. In the remainder of this manual, the UP and DOWN arrow pushbuttons are referred to simply as UP and DOWN.

UP represents the membrane pushbutton,

and

DOWN represents the pushbutton.

Also, the "SELECT", "ENTER", and "ACK" push-buttons are referred to as simply SELECT, ENTER, and ACK.

In order to distinguish them from surrounding texts, references to readouts on the LCD will be made using a special typeface. For example:

LCD READOUT

This font is not an **exact** replica of the actual LCD, but the text accurately reflects the display on your modules.

Description

The Cable Concentrator System consists of an Input Module (IMM) and an Output Module (OMM).

The IMM collects and "concentrates" up to sixteen inputs, and transmits them as a single signal to the OMM. The OMM receives this signal from the IMM, then "separates" it and provides up to sixteen outputs in a customer-defined format.

Any IMM/OMM pair is capable of concentrating, transmitting, receiving, and separating up to sixteen inputs and outputs. By using a "daisy chain" serial connection technique, up to eight units can be used on either end of a CCS link. This allows the user to accommodate up to one-hundred and twenty-eight inputs and their respective outputs in a CCS system. Figure 1 illustrates one type of daisy chain.

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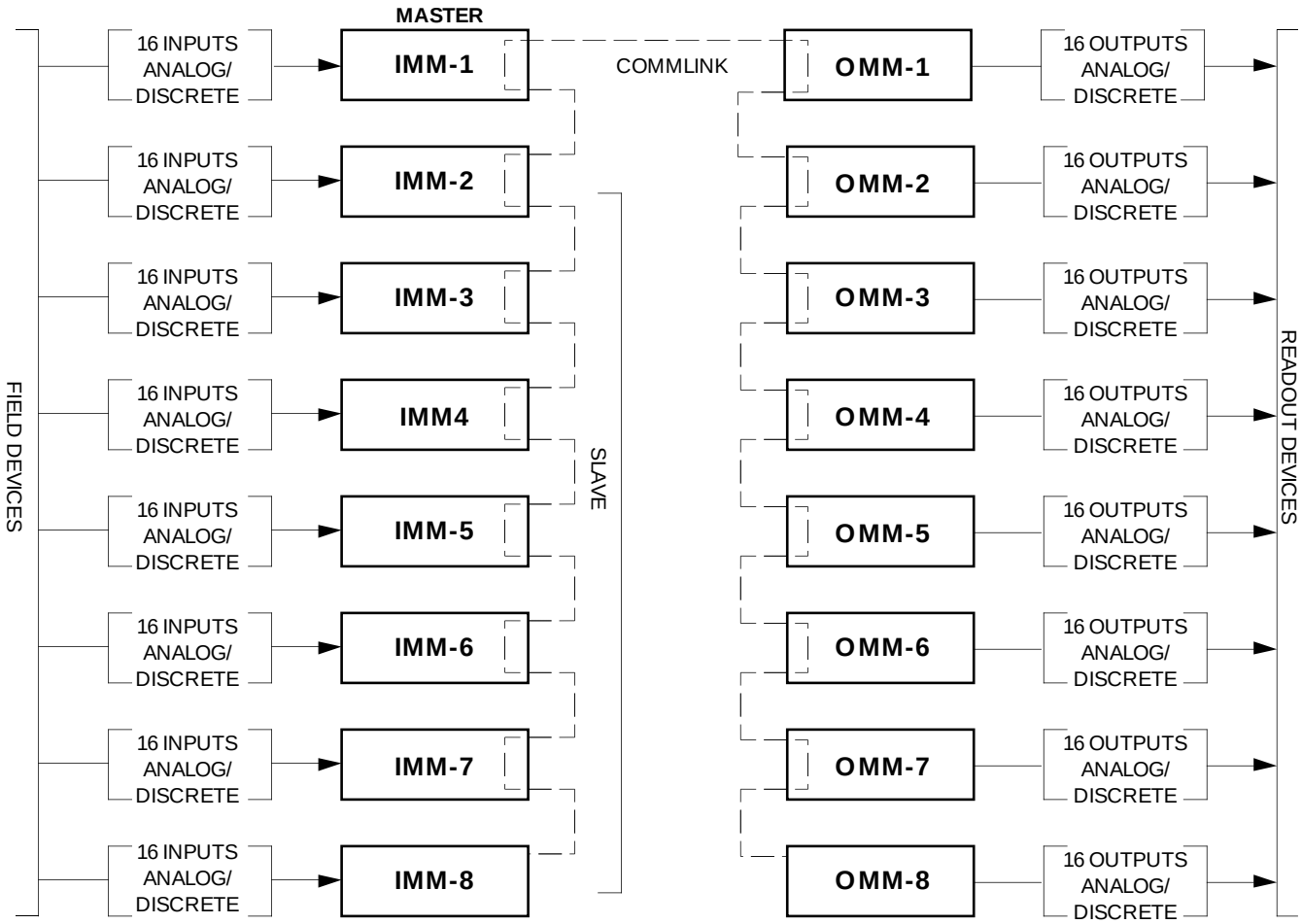
Figure 1. *Connecting the CCS in a "Daisy Chain" Application*



As the figure shows, in a multi-module application, one IMM must be configured as the System Master. All other IMMs must be configured as "Slaves". The setting of the Master/Slave operating parameter is described in the Communications Setup section of this manual.

The CCS with the Modbus option allows the IMMs and OMMs to be connected independently to a DCS system in a peer-to-host arrangement. It uses Modbus RTU® protocol for communications. These units cannot be interchanged or combined with non-Modbus units. Refer to the Specifications list and Ordering Information Table for more information.

Data Communications

The CCS can be ordered in either a peer-to-peer configuration, or with the –MBR option in a peer-to-host setup.

Communications in a peer-to-peer configuration use a RS-485 proprietary protocol. Peer-to-host CCS (-MBR option) use RS-485 with Modbus® RTU for communications between a PC or DCS and IMMs or OMMs. Refer to the Specifications list and Ordering Information Table, later in this manual, for more information on baud rates, link length and the –MBR option.

Modbus RTU is a registered trademark of MODICON, Inc., North Andover, MA 01845

Special Compatibility Note

This manual is intended for use with non-Modbus CCS modules with module serial numbers 707795 and above and Modbus units with version 1.0 firmware.

Operational and performance data in this manual may not apply to Systems using earlier firmware releases.

The IMM and OMM

CCS hardware modules are packaged in compact, aluminum DIN-style rail-mount housings. Refer to the Installation section of this manual for the physical dimensions of each housing style.

For applications requiring dust- or moisture-tight protection, or corrosion resistance, enclosures are available. Contact your Moore Industries Sales Representative for more information.

The Discrete IMM. This type of module is configured by the factory so that all of its sixteen channels accept and process discrete inputs exclusively. The user can configure each channel to accept either contact closure or transistor/transistor logic (TTL) inputs.

The Universal IMM. This type of module is capable of accepting and processing any combination of discrete or analog inputs. The user selects the type of input to be processed by each channel.

Analog-configured channels can be set to accept either current or voltage input. Discrete-configured channels, as in the Discrete version of the IMM, are selectable for either contact closure or TTL inputs.

The Discrete OMM. As in the Discrete IMM, this module is factory-set to process and output discrete signals exclusively. There are two types of Discrete OMMs available.

One provides the user with the capability of configuring individual channels for either contact closure or TTL output. The other is set at the factory with contact closure outputs exclusively. This second type can be ordered with internal miniature power relays normally open or normally closed.

The Universal OMM. This type of module provides any user-selected combination of analog or discrete outputs (miniature power relay output not available).

The Specification and Ordering Information tables contain the operational and performance specifications for the CCS.

Figure 2 shows a generic front panel. On your System's units, the IMM or OMM designator appears in the upper left corner of the panel.

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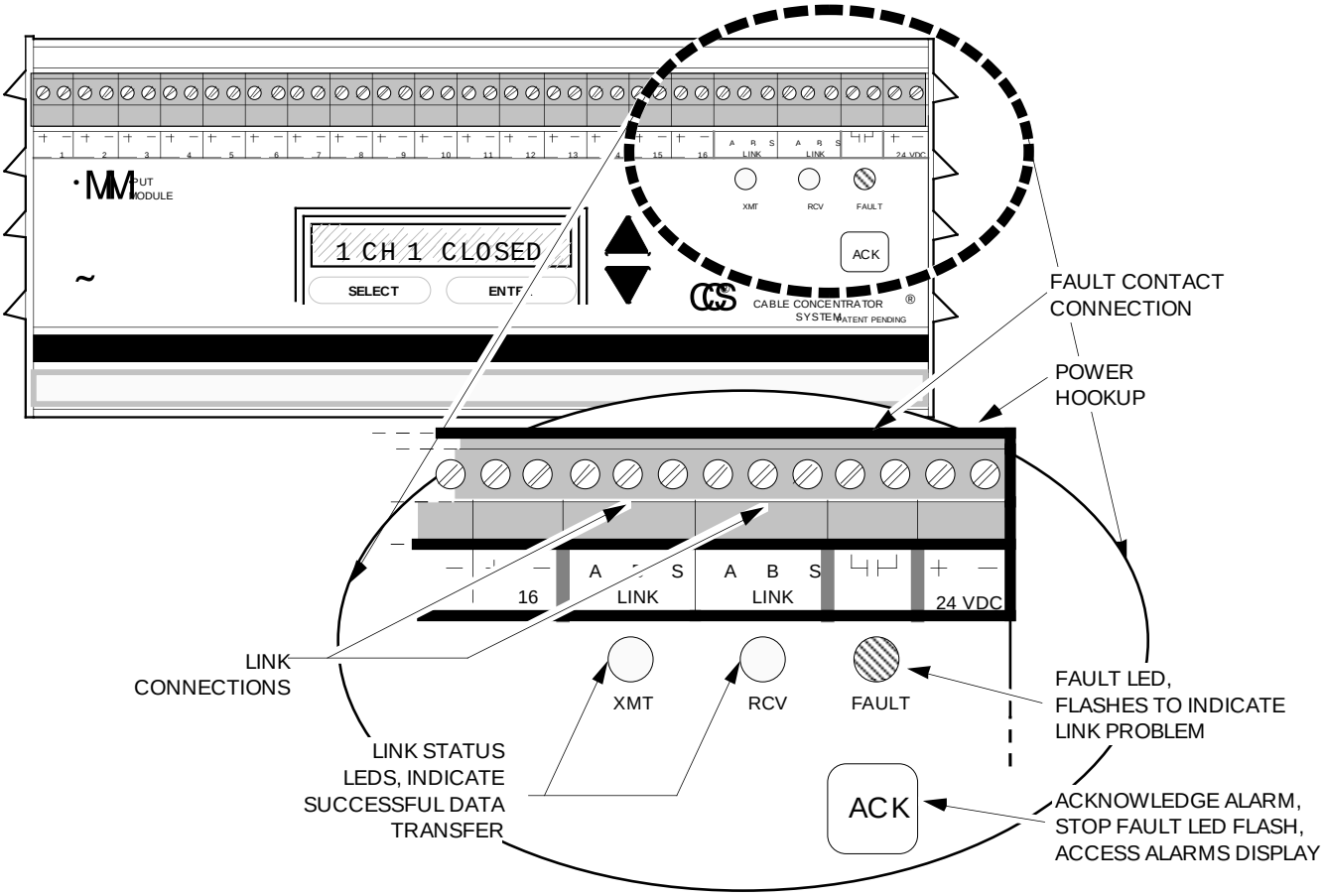
Figure 2. *CCS Modules' Front Panel*



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Specifications

Performance	**Calibration Capability:** ±0.1% of maximum span for analog input and ±0.1% of maximum span for analog output **Isolation:** IMM Input Module: Analog/TTL inputs isolated to 175Vdc or ac peak between channels; 500Vac between inputs, power, and data link OMM Output Module: Analog outputs have common negative; discrete outputs are isolated 500Vac between outputs/power/data link **Impedance:** IMM Voltage: 1M½ IMM Current: 250½ **Drive Capability:** OMM Analog: 0-20mA into 0-850½; 0-10V output limited to 20mA OMM Discrete (Open Collector): External power, 42Vdc @ 100mA **System Fault Contact:** 120Vac @ 0.5A or 24Vdc @ 1A (non-inductive) **Discrete Output Protection:** MOV protected on all contact closure and relay channels (discrete channels on Universal modules are not protected)
COMM Link (Twisted Wire Pair)	**Baud Rate:** Any rate from 300 through 19,200 is user-selectable. Modbus units: Any rate from 600 through 19,200 is user-selectable **Character FormatÐModbus Units:** Factory set, 1 start bit, 8 data bits, 1 stop bit, no parity **Transmission Range:** Using 24AWG twisted pair wiring, maximum of 2 miles (3.2km) @ 4800 baud or less; maximum of 1 mile (1.6km) @ 9600 baud; maximum of 0.5 miles (0.8km) @ 19200 baud (modems and repeaters are offered to increase allowable transmission distances) **Surge Protection:** Order Part Number 800-893-61 for communication link surge protector (see CCS Accessories for details)
Power Supply	**IMM Input Module (Current consumption @ 24Vdc, nominal):** Analog Inputs: 175mA Discrete Inputs: 335mA Mixed Inputs (Universal Module): 335mA maximum **OMM Output Module (current consumption @ 24Vdc, nominal):** Analog Outputs: 500mA Discrete Outputs: 500mA with "R" output type, 335mA with "T" output type Mixed Outputs (Universal OMM): 500mA
Ambient Temperature	**Operating Range:** 0 to 65¡C (32 to 149¡F) **Ambient Temperature Effect:** Less than ±0.01%/¡C (analog inputs and outputs from 0 to 65¡C)
Adjustments	**Front Panel Pushbuttons:** Configure and calibrate module channels, configure master/slave, clear alarms, and activate/de-activate modem software **Internal Solderless Jumpers:** Configure channels for analog (current or voltage) or discrete (contact closure) inputs/outputs
Indicators	**Integral Display:** 16 character LCD shows module identification number, channel number, and process value during configuration, calibration, and operation **Front Panel LEDs:** Indicate module is transmitting/receiving data properly, and when the unit is in a fault condition
Weight	2lbs., 14 oz. (1.3Kg) per module

Ordering Information

Unit	Input	Output	Power	Options	Housing
IMM Input Module (16 channels per module; 8 modules per system maximum) **OMM** Output Module (16 channels per module; 8 modules per system maximum) NOTE: For Peer-to-Peer Systems, IMM and OMM modules must be ordered in pairs, with a maximum of eight pairs per system.	(See Table 1 for descriptions) IMM INPUT MODULE: **U** 16 input channels configured to accept any combination of analog and/or discrete signals; in Peer-to-Peer Systems, pair with OMM with ÒUÓ output type **D** 16 input channels accept discrete signals; In Peer-to-Peer Systems, pair with OMM with ÒRÓ or ÒTÓ output type OMM OUTPUT MODULE: **RS485** communication from a matching IMM module or computer-based host	(See Table 1 for descriptions) IMM INPUT MODULE: **RS485** to a matching OMM or computer-based host OMM OUTPUT MODULE: **U** 16 output channels configured to accept any combination of analog and/or discrete signals; In Peer-to-Peer Systems, pair with IMM with ÒUÓ input type **R** 16 relay output channels (-NC or -NO option required) **T** 16 discrete output channels discrete (contact closure)	**18-30DC** 24Vdc nominal or 24Vac, ±10%, 50/60Hz NOTE: Moore Industries DPS 1200 and SMP Power Supplies are recommended for use with the CCS. Ask for Datasheets 11.1 and 11.3.	**ÐMBR** MODBUS RTU Communication link for Peer-to-Host System (not available with Peer-to-Peer Systems) **ÐNC** Normally closed relays (R-type OMM only, see Table 1) **ÐNO** Normally open relays (R-type OMM only, See Table 1)	**DIN** Aluminum DIN-style rail-mount housing mounts on 32mm G-type (EN50035) and 35mm Top Hat (EN50022) rails (Single and multi-unit enclosures and cabinets available, call for details)

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Table 1. Compatible Module Types and Input/Output Possibilities

Module Type	Signal Direction	Input/Output Signal Possibilites
UNIVERSALÐAnalog and/or Discrete Inputs with Analog and/or Discrete Outputs		
IMM Universal Inputs (**U**)	Input	Each channel is user-configurable to accept any combination of: Analog SignalsÐCurrent (any range between 0-20mA such as 4-20mA, with 8mA span minimum) or voltage (any range between 0-10V such as 1-5V, with 4V span minimum) Discrete SignalsÐContact closure (switch point 3.0Vdc) or TTL signals configurable to represent HIGH/LOW, OPEN/CLOSE, or any ON/OFF state
	Output	RS-485 for transmission to a matching Universal (U) OMM, or to a computer-based host
OMM Universal Outputs (**U**)	Input	RS-485 transmitted from a matching Univesal (U) IMM, or from a computer-based host
	Output	Each channel is user-configurable to output any combination of: Analog SignalsÐCurrent (any range between 0-20mA such as 4-20mA, with 8mA span minimum) or voltage (any range between 0-10V such as 1-5V, with 4V span minimum). Discrete SignalsÐcontact closure (42V, 100mA maximum at 1.5V drop) or TTL signals configurable to represent HIGH/LOW, OPEN/CLOSE, or any ON/OFF state
DISCRETEÐDiscrete Inputs with Mechanical Relay or Contact Closure Outputs		
IMM Discrete (**D**)	Input	Each channel is user-configurable to accept any combination of: Contact Closure (switch point 1.0Vdc or TTL signals configurable to represent HIGH/LOW, OPEN/CLOSE, or any ON/OFF state
	Output	RS-485 for transmission to a matching OMM with "R" or "T" output type, or to a computer-based host
OMM with **R**-Type Outputs	Input	RS-485 for transmission to a matching Discrete (D) IMM, or from a computer-based host
	Output	Mechanical Relay Outputs: Normally-closed (ÐNC option) or normally-open (ÐNO option) relay output rated 5A @ 250Vac or 5A @ 30Vdc (resistive loads)
OMM with **T**-Type Outputs	Input	RS-485 transmitted from matching Discrete (D) IMM, or from a computer-based host
	Output	Contact Closure (42V, 100mA maximum at 1.5V drop) signals configurable to represent HIGH/LOW, OPEN/CLOSE, or any ON/OFF state

Options

The following options are available with the CCS:

–MBR Modbus RTU. A communication link for Peer-to-Host systems using standard Modbus (RS-485) protocol. Character format is fixed as:

1 start bit, 8 data bits, 1 stop bit, No parity

Provides trouble-free interface with MMI software packages, PC, PLC, and DCS systems and with other networkable instrumentation.

–NC Normally Closed Relays. For R-type OMMs only. Relay output rated 5A @ 250Vac or 5A @ 30Vdc (resistive loads).

–NO Normally Open Relays. For R-type OMMs only. Relay output rated 5A @ 250Vac or 5A @ 30Vdc (resistive loads).

CCS Model Numbers

To order additional or replacement modules for your system, refer to the Ordering Information table and "build" a model number using the information in bold text. Specify the following in order:

Product / Input / Output / Power / Option [Housing]

For a CCS, specify:

IMM / U / RS485 / 18-30DC / [DIN]

or

OMM / RS485 / U / 18-30DC / [DIN]

The CCS Menu

The CCS uses a simple hierarchical menu to set and control both System-wide and individual module operating parameters. The menu is displayed on modules' LCDs. The front panel membrane pushbuttons allow the user to view and change the settings and status of the:

Communications Setup:
MASTER/SLAVE (for IMMs only. **Not available on MODBUS units**)
UNIT ID
BAUD RATE
and
MODEM/NO MODEM (**Not available on MODBUS units**)

Configuration of Channels:
(input for IMMs and output for OMMs)
CONTACT CLOSURE
TTL
VOLTAGE
or
CURRENT

Calibration of Channels:
(relative to your application's input and output)
ZERO
FULL SCALE
INVERTED OUTPUT
HIGH/OPEN or LOW/CLOSED
DEFAULT VALUE
DEFAULT TO LAST VALUE (ENABLE/DISABLE)

Inverted output is possible with discrete-configured channels only. Zero and Full Scale input and output settings are available in Universal modules only. Voltage and current are not available with discrete modules configured by the factory.

Accessories

The link between IMM and OMM in a standard CCS is a single, RS-485 signal. This signal may be transmitted over a twisted wire pair for up to two miles, depending upon the baud rate selected for use in your System (refer to specifications listing).

Incorporating Moore Industries Link Converter Module (LCM) or Link-to-Fiber Module (LFM) in the System makes it possible, in some cases, to link modules over greater distances using ordinary telephone lines or fiber optic communications cabling.

The following paragraphs comprise an overview of these, and other DIN-style accessories manufactured by Moore Industries. See your Sales Representative, or contact Moore Industries for more information.

DIN-Style Power Supply, DPS-1200 – Solid-state, compact power supply with plug-in terminal connectors and snap-in mounting.

Link Converter Module, LCM – Compact unit for converting the CCS's RS-485 signal to standard RS-232C or RS-422 formats. Also available, Moore Industries' Short Haul Modem (continuous link, non-switched), Dedicated Line Modem (leased lines), or Dial-up Modem (standard switched lines).

Two LCMs and two modems (up-link and down-link) are required for each CCS, if modem communications are desired (also requires MODEM configuration in System menu. See COMM SETUP section of this manual).

Link-to-Fiber Module, LFM – DIN-style unit Converts the CCS's RS-485 signal to communication-grade light. If fiber-optic communications are required for your application, two LFMs are required per CCS (up-link and down-link).

Redundant Communication Link Module, RLM – Automatically switches the CCS signals to a secondary link in the event of communications interruption on the primary link. Two RLMs are required per CCS for up-link and down-link (can only be used in peer-to-peer configurations).

Supply Switching Module, SSM – Automatically switches power supplies in the CCS in the event of a failure.

Documentation

Included with each CCS, in addition to this User's Manual, you are shipped:

- **A System Specification sheet**
- **Module Configuration Records (1 per module)**
- **Module Configuration Record quick-reference Cards (also 1 per module)**

The System Specification sheet documents how individual modules were configured within your CCS. The Module Configuration Record lists the configuration of each channel in a given module. Both reference sheets list the modules in your system by serial number, and may be used to identify and keep track of, for example, which IMM is the Master, or which OMMs are configured for converting or inverting output values.

The Module Configuration quick-reference card is also intended to function as an aid in keeping track of changes made to a Module's operating parameters. Grease pencil or erasable marker can be used to note operating parameter selections or changes, and the card may be stored in the compartment that comprises the unit's bottom panel.

Setting Configuration Jumpers/Bench Check

Prior to shipment, every CCS is subjected to rigorous testing by our team of skilled technicians. Every product Moore Industries manufactures, sells and services is guaranteed to meet the strict quality standards that have become synonymous with our name.

Before placing your CCS into service, a bench check of basic operation is recommended to ensure that the unit hasn't sustained any damage during transit.

Even if a unit has been configured to your specifications by the factory (factory calibration), it is a good idea to perform a simple bench check. The procedures provide a safe means to uncover any unit damage that may have occurred during shipping, and offers a familiarization with CCS operation in the safety of a testing environment, separate from the intended process or application.

Configuration Jumpers.

The settings of jumpers on pc board 3 (PC3-See figure 3) in each IMM or OMM determine the type of signal that each of its channels will process, and the condition (NO or NC) of its fault relay contacts.

Moore Industries records these jumper-dependent operational characteristics on the Module Configuration Record, and packs a copy of this record inside the storage compartment of each module.

The following sections describe the procedures for disassembling CCS modules and setting the jumpers that control channel configuration and fault relay contacts.

Before going on, check the Module Configuration Record of each of the modules in your System. If the configuration of the channels, and the fault contact condition on the IMMs and OMMs are correct, the module need not be disassembled. Skip to the Bench Check section of this manual.

NOTE:
It is strongly recommended that a module be bench checked whenever any jumpers are moved.

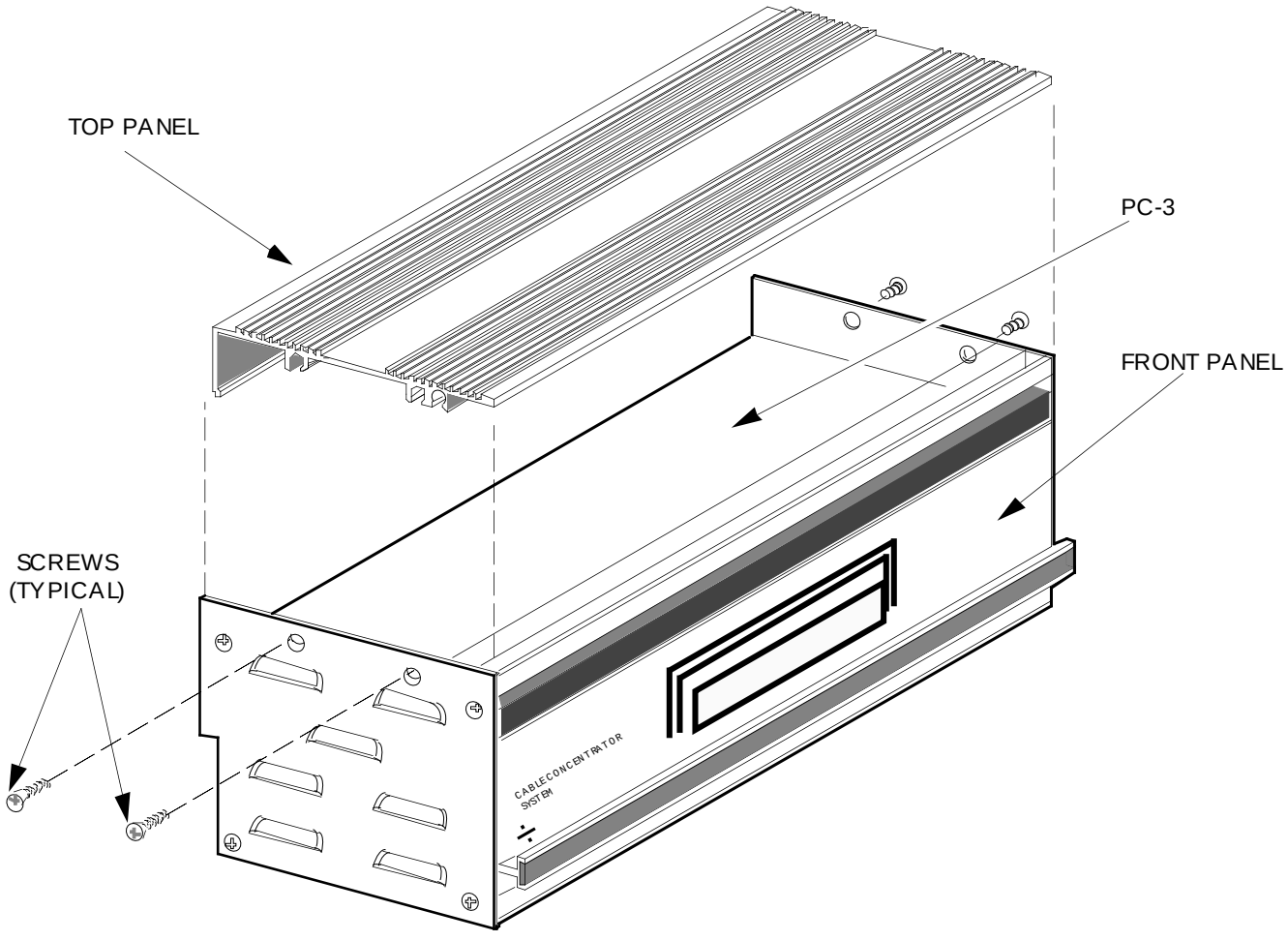
Module Disassembly. To verify or change the position of the CCS module configuration jumpers, the top panel of the module housing must be removed. All of the customer-set jumpers in the CCS modules are located on PC board 3 (PC3).

It is recommended that the procedures in these sections be performed at a technician's bench or in a similar laboratory setting. To complete the procedures, you will need a small Phillips-head screwdriver and a pair of narrow, needle-nose pliers.

Figure 3 illustrates the disassembly of CCS modules, and the location of PC3. The style of housing employed by discrete OMMs equipped with miniature power relays is slightly different than the one depicted, but regardless of which style housing is being disassembled, the two top-most screws on each side panel must be removed.

CAUTION:
Remove any power connection before disassembly.
Electrostatic discharge can permanently damage the module.

Figure 3. *Disassembling the CCS Modules*



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Setting IMM Configuration Jumpers

There are sixteen sets of labeled jumpers on PC3 of the IMM. Each set (four jumpers per set) corresponds to a channel in the IMM, and the sets are numbered J1 through J16. The J1 jumper controls channel 1, J2 controls channel 2, etc.

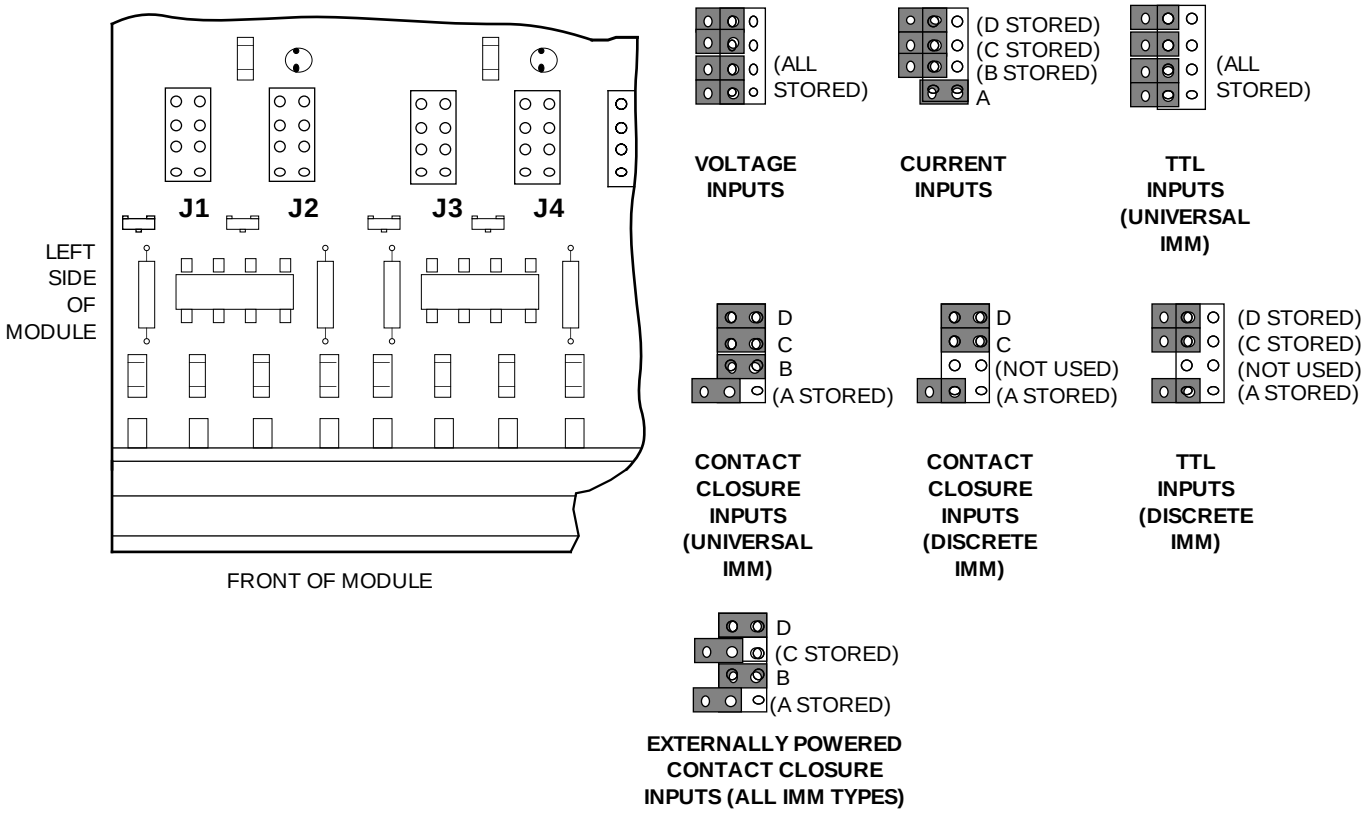
Figure 4 shows the first four sets of jumpers on the board as they will appear when the unit is oriented upright with the LCD facing the operator. The positions of the jumpers are designated as “A”, “B”, “C”, and “D”.

Refer to Table 2 to determine the configuration of each IMM channel as required by your application, and use figure 4 to set the jumpers. If a jumper is not set, it should be stored on one pin only.

Table 2. *Positioning IMM Configuration Jumpers*

For Universal IMM	Install Jumper(s)
Voltage	NONE (store all jumpers)
Current	A
TTL	NONE (store all jumpers)
Contact closure	B, C, D
For Discrete IMM	**Install Jumper(s)**
TTL	NONE (store all jumpers)
Dry Contact Closure	C, D
Externally Powered Contact Closure	D

Figure 4. *Setting IMM Configuration Jumpers*



Setting OMM Configuration Jumpers

Sixteen sets of OMM configuration jumpers are located on PC3. The jumper sets are not labeled on the OMM board, but with the module front panel upright and facing the operator, the left-most set corresponds to channel 1 and the right-most set corresponds to channel 16.

Figure 5 shows the first six sets of jumpers, and illustrates the positioning required for the various output configurations. Table 3 summarizes the installation. Unused jumpers can be stored on one pin.

NOTE:
Discrete OMMs configured by the factory for relay output do not use customer-selectable jumpers for channel configuration.

Refer to the Specifications listing for data on the output of the Discrete OMM.

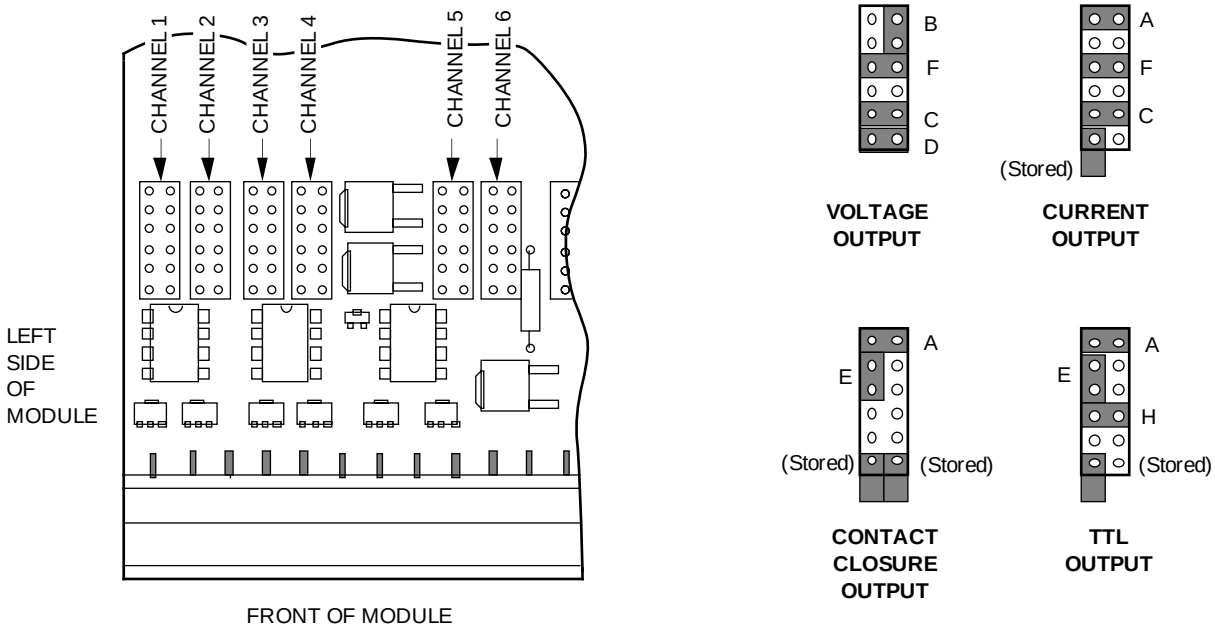
Table 3. *Positioning OMM Configuration Jumpers*

Desired OMM Output	Install Jumpers
Voltage	B, C, D, F
Current	A, C, F
Contact Closure	A, E
TTL	A, E, H

Setting Fault Contact Configuration Jumpers

All IMMs and OMMs are equipped with a fault relay. The output of the relay is accessible at the Fault Contact terminals on the front panel, and the setting of one internal jumper on PC3 determines how the relay contacts will operate.

Figure 5. *Positioning OMM Configuration Jumpers*



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With the module front panel upright and facing the operator, the jumper can be found on the front, right-most corner of the board.

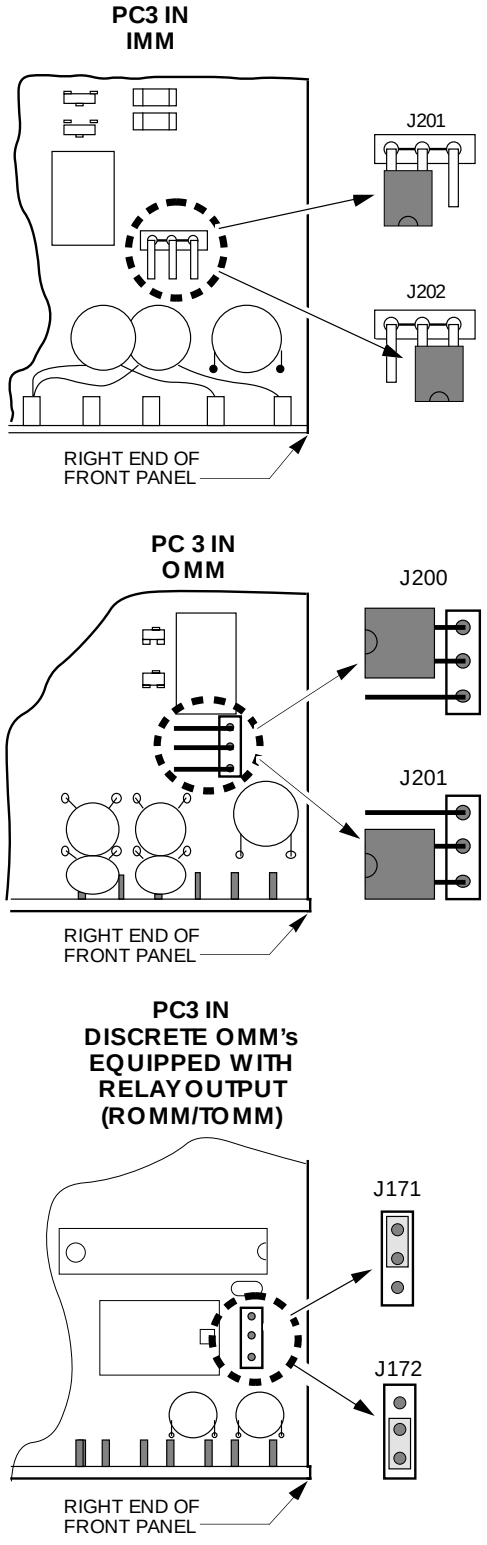
Figure 6 shows the location of the Fault Contact Configuration jumper on PC3 of all three types of IMM and OMM.

Use Figure 6 and Table 4 to set the jumper for OPEN or CLOSED in the event of a link problem or power loss.

Table 4. *Positioning Fault Contact Jumper*

Module Type	Desired Fault Relay Contact Operation	Install
IMM	OPENS in alarm or power loss	J201
	CLOSES in alarm or power loss	J202
OMM	Closes in alarm or power loss	J200
	OPENS in alarm or power loss	J201
DISCRETE OMM Configured for RELAY OUTPUT	OPENS in alarm or power loss	J172
	CLOSES in alarm or power loss	J171

Figure 6. *Positioning the CCS Modules' Fault Contact Configuration Jumpers*



Bench Check–Non-Modbus Units

This section provides the instructions for a simple test of the basic operation of the modules in your CCS. For CCS systems using Modbus, refer to the Bench Check section for Modbus units. With the Bench Check, the user may verify operating levels and channel configuration settings, and become familiar with the basic connection and operating techniques of the CCS in a controlled environment, isolated from any actual application.

The equipment listed in Table 5 is needed when bench checking the CCS. These items are not supplied by Moore Industries, but should be available in most testing labs.

Table 5. *CCS Bench Check Equipment*

Equipment	Specifications
Signal Source	Universal Modules: Capable of Voltage and Current output, accurate to within 0.01% of span Discrete Modules: ON/OFF switch or similar device
Digital Multimeter	Fluke Model 8060 or equivalent; accurate to within 0.01% of span
Power Supplies (2)	Contact Closure-configured IMMs and OMMs: 335mA TTL-configured IMMs: 175mA TTL-configured Discrete OMMs: 335mA Universal IMMs: 335mA Universal OMMs: 500mA RTOMMs: 450mA
Screwdrivers	Small Philips-head and Slotted type with head width no greater than 2.54 mm (0.1 in)

Special Considerations – The IMM as Master or Slave. In Systems with only one IMM/OMM pair, the setting for the IMM must be Master. In multi-IMM Systems, one IMM must be configured as a Master and all others as Slaves. Modbus units cannot be configured as Masters or Slaves.

Accordingly, the factory default setting in single-IMM Systems is “Master”. In multi-IMM Systems, the System Specification sheet identifies the Master IMM.

Earlier versions of the CCS IMM used a jumper to control the unit’s functioning as a MASTER or SLAVE. The System described in this manual uses the System Menu to control this operating parameter. The procedure for setting Master/Slave is outlined in the COMM SETUP section of this manual.

The Bench Check Procedure contains the instructions for connecting and bench checking a Slave IMM.

Figure 7 shows the Bench Check setup for non-Modbus units. It depicts the connection of a Master IMM to an OMM. If you have a multiple-IMM CCS, use the System Specification sheet to select the Master IMM.

CAUTION:
Always make sure components and tools are properly safeguarded against accidental electrostatic discharge.

To Setup for the Benchcheck:

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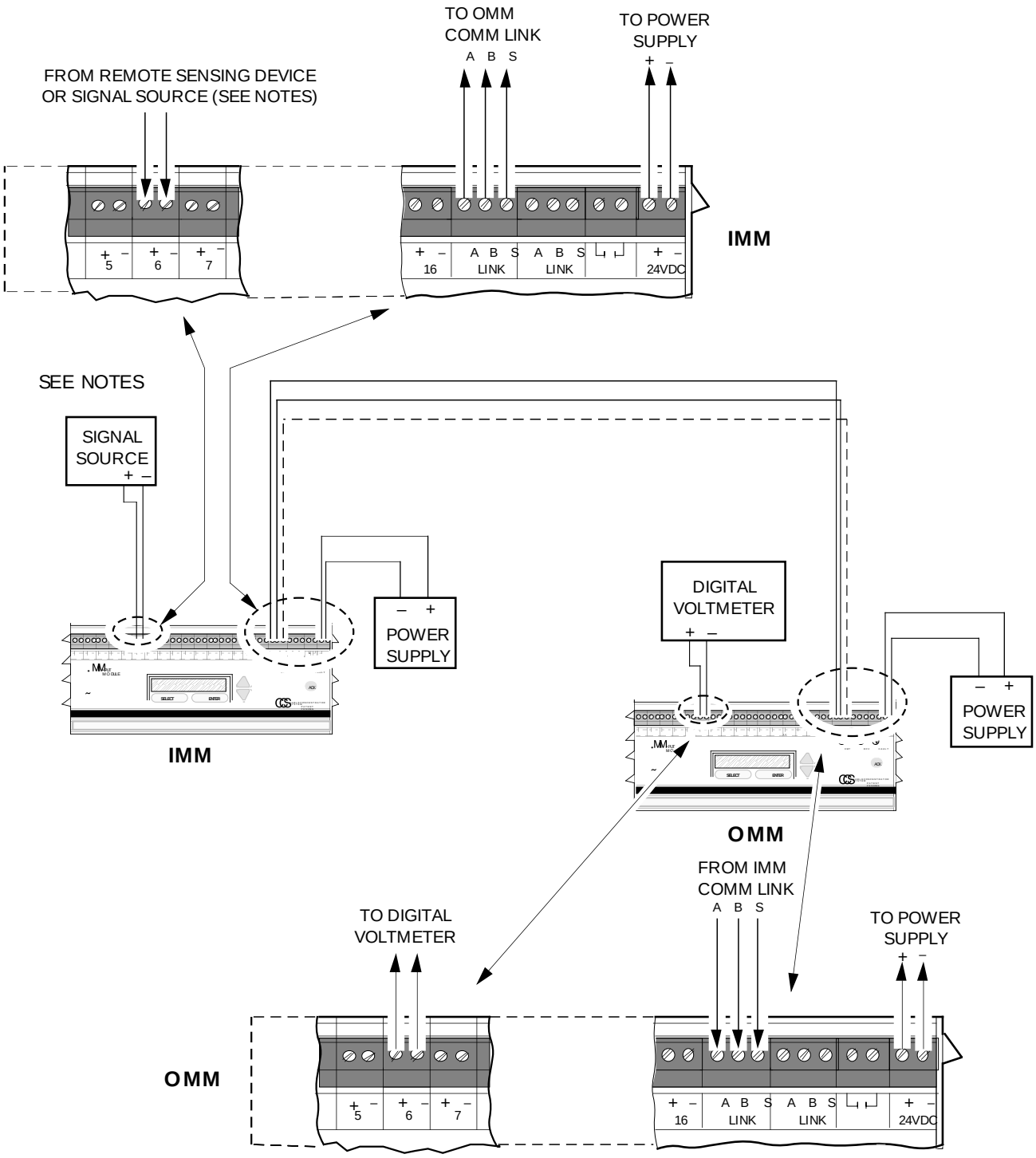
Figure 7. *Bench Checking the Non-Modbus CCS*



NOTES:

1. SIGNAL SOURCE MUST BE CONNECTED TO AN INPUT CHANNEL CONFIGURED TO ACCEPT THE TYPE SIGNAL PRODUCED (e.g. CURRENT,VOLTAGE,TTL).
2. CONTACT CLOSURE CHANNELS REQUIRE AN ON/OFF SWITCH, OR SIMILAR DEVICE.

1. **Refer to the IMM's Module Configuration Record, and select an IMM channel compatible with your signal source (current, voltage, contact closure, etc.).**

   If unsure about the configuration of a channel, return to the Jumper Setting section of this manual, and if necessary, disassemble the module(s) to confirm the channel configuration status.

2. **Select the same-numbered channel on the OMM, and use its Module Configuration Record to verify compatibility (analog in, analog out; discrete in, discrete out, etc.).**

3. **Use the slotted screwdriver to loosen terminal block screws, and connect the appropriate signal source to the selected IMM channel, positive (+) signal lead to positive (+) module terminal, and negative (–) lead to negative (–) module terminal.**

4. **Connect the multimeter to the terminals of the selected channel on the OMM.**

NOTE:

If performing a check on an analog-configured channel, a 250 ohm shunt resistor may be connected in parallel with the OMM terminals and the multimeter.

If this modification is used in the setup, the digital multimeter will measure the voltage drop across the resistor.

5. **Connect the two modules' Comm Links to each other. Either set of link terminals, labeled "A B S" on the front panel, may be used.**

   Make sure that the "A" link terminal of the IMM is connected to the "A" link terminal of the OMM, and that the "B" terminal of the IMM is connected to the "B" terminal on the OMM.

6. **Connect a source of 18-30 Vdc or 24 Vac to the power terminals of the modules. With dc power, make sure to connnect (+) to (+) and (–) to (–).**

7. **Apply the appropriate power to the setup, and allow the units to complete the self-check (approximately 5 seconds).**

NOTE:

Upon power-up, CCS modules emit a short beep, the "XMT", "RCV", and "FAULT" LEDs flash, and the units begin a self-check of their firmware and basic circuitry. If problems are encountered, a flashing error message will appear on the LCD, and the front panel "FAULT" LED will flash. This may be accompanied by a steady warning tone. If this occurs, refer to the Troubleshooting section of this manual.

NOTE:

Make sure that the firmware installed in the modules being checked is compatible with this manual.

When power is applied to modules in the CCS, the first readout to appear on the LCD is the Module Type/ Version Display. This display shows the version of the firmware installed in the module.

To Bench check the CCS:

1. **Verify that the Channel Status Display appears on the LCDs of the IMM and OMM being checked. The following is an example of a Channel Status Display:**

1 = The Module ID Number. 1-8 are possible.

CH 1 = The Channel Number. 1-16 are possible.

CLOSED = The Status of the channel being displayed; closed, open, high, low, or a value that represents a percentage of span.

2. **Supply the signal to the IMM.**
3. **Press UP or DOWN on the IMM until the channel being checked is displayed on the LCD.**
4. **Press UP or DOWN on the OMM until the channel being checked is displayed on the LCD.**
5. **Observe the display on both modules, and use the multimeter and Module Configuration Records to verify that the type of signal at the OMM terminals is appropriate for the input on the IMM.**

   For example, analog input at the IMM should output as analog signals on the OMM, Contact Closure "in" should produce Contact Closure "out", etc.

   Module operations unaffected by internal jumper positioning, such as inverted, scaled, or converted outputs, should be verified on the Module Configuration Record. The procedure for changing these settings will be discussed later in this manual.

6. **When these channels have been bench checked, choose another pair of channels and repeat steps 1- 5 until all channels are checked.**

To Bench Check Slave IMMs in a multi-module ("Daisy-Chained") CCS, complete the procedure for the Master IMM and its paired OMM first, then:

1. **Start with the setup depicted in Figure 7, with the Master IMM and its paired OMM, then choose a slave IMM and its paired OMM.**
2. **Connect the link terminals on the Slave IMM to the matching set on its paired OMM; "A" to "A", "B" to "B", and "S" to "S".**
3. **Connect the second set of OMM link terminals to the remaining set of link terminals on either the Master IMM or tiits paired OMM.**
4. **Connect a source of 18-30 Vdc or 24 Vac to the power terminals of the Slave IMM and its OMM. If using dc power, connect (+) to (+) and (–) to (–). Do not apply power to the setup at this time.**
5. **Go to Step 2 of the Bench Check and perform the IMM operation on the Slave IMM. Where the instructions call for an OMM, use the OMM that is paired with the Slave IMM.**

NOTE:

During bench check, the "XMT" and "RCV" LEDs on the IMM and OMM will flash. This indicates a data transfer.

Bench Check Example

The Module Configuration Record for a Master IMM lists its Module ID number as 1, and channel 5 as configured for Contact Closure input.

A field device that supplies a dry Contact Closure signal (>300 ohms open and <100 ohms closed) is connected to channel 5 of this IMM.

The Module Configuration Record for OMM #1 in this System shows that it is factory-configured as a discrete OMM, and that it is equipped with the Normally Open Option of the miniature power relay outputs (ROMM, -NO).

These modules are connected as described in the Bench Check Setup. After appropriate power is applied to both units and the firmware's self-check is completed, the contact in the signal source is opened.

DOWN is pressed on both modules until the following is displayed on the IMM:

```
1 CH 5 OPEN
```

And this appears on the LCD of the OMM:

```
1 CH 5 OPEN
```

The meter shows infinite (>300) ohms resistance.

When the signal source contacts are closed, the IMM will display changes appropriately, and the OMM also will display the change in relay state. The multimeter indicates negligible (<100 ohms) resistance.

Bench Check–Modbus Units

This section provides the instructions for a simple test of the basic operation of the modules in your CCS. With the Bench Check, the user may verify operating levels and channel configuration settings, and become familiar with the basic connection and operating techniques of the CCS in a controlled environment, isolated from any actual application.

This section is for CCS units equipped with Modbus. If your unit does not have the Modbus option, refer to the bench check section for non-Modbus units earlier in this manual.

Figure 8 shows the Bench Check setup for Modbus units. It depicts the connection of IMMs and OMMs to a PC. The IMMs and OMMs may be connected to the PC simultaneously during bench check, however only one module can be bench checked at a time.

CAUTION:

Always make sure components and tools are properly safeguarded against accidental electrostatic discharge.

NOTE:

Make sure that the firmware installed in the modules being checked is compatible with this manual.

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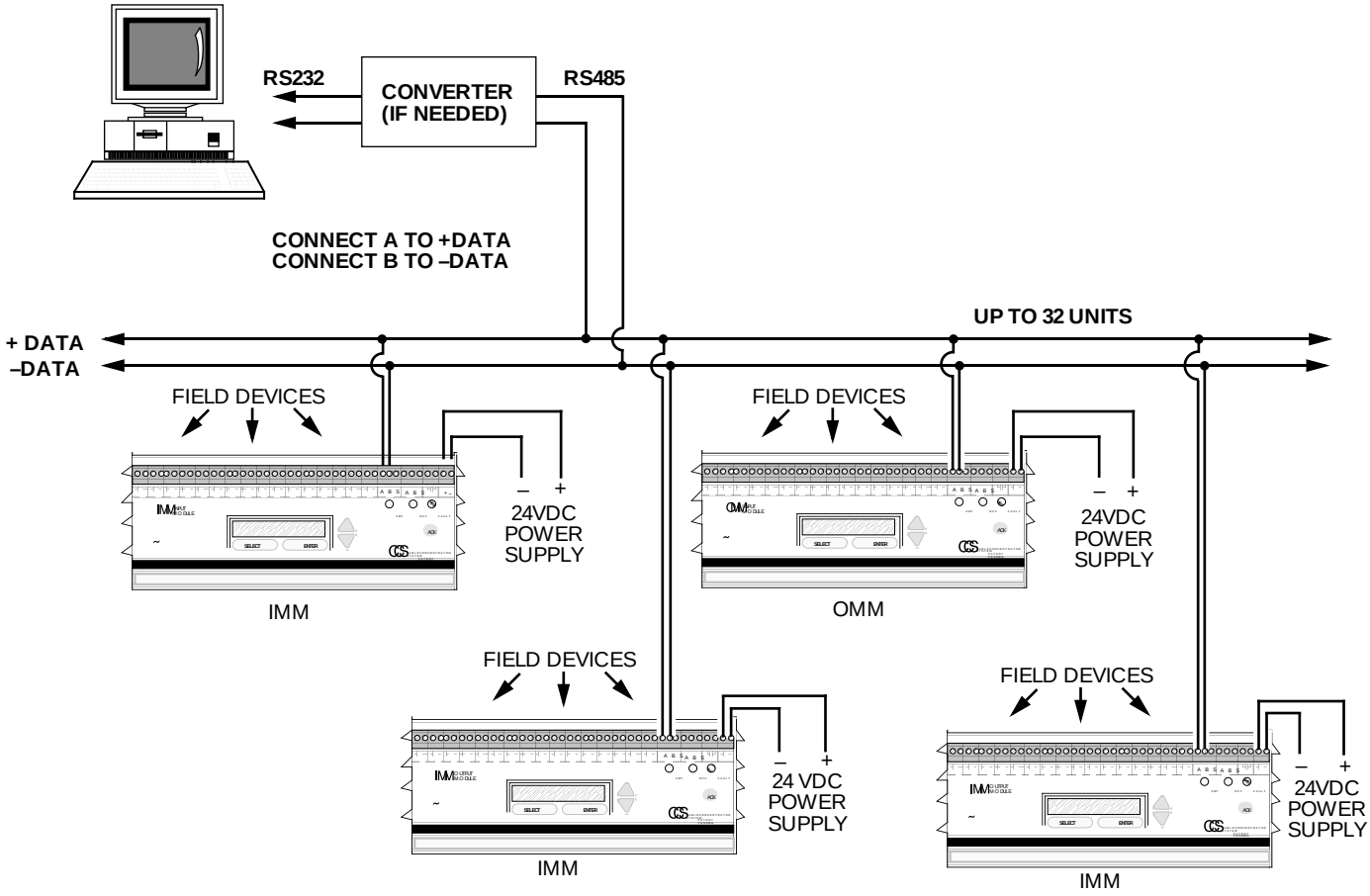
Figure 8. *Bench Checking the Modbus-equipped CCS*



When power is applied to modules in the CCS, the first readout to appear on the LCD is the Module Type/ Version Display. This display shows the version of the firmware installed in the module.

To Bench Check the CCS:

1. **Connect the module(s) Comm links to the PC. The "A" link terminal connects to +Data ("A", if using a converter) and the "B" link terminal connects to –Data ("B" , if using a converter).**

2. **Connect a source of 18-30Vdc or 24Vac to the power terminals of the module(s). With dc power, make sure to connect (+) to (+) and (–) to (–).**

3. **Verify that the Channel Status Display appears on the LCDs of the IMM and OMM being checked. The following is an example of a Channel Status Display:**

```
1 CH 1   CLOSED
```

1 = The Module ID Number. 1-99 are possible.

CH 1 = The Channel Number. 1-16 are possible.

CLOSED = The Status of the channel being displayed; closed, open, high, low, or a value that represents a percentage of span.

4. **Execute a Report Slave ID (Command 17 or 11 HEX).**
5. **The Slave ID of the unit will appear on the PC. Table 6 shows the slave IDs.**
6. **Bench Check is complete.**

Table 6. *Unit Slave IDs*

Unit Type	Slave ID
OM U	12FF
OMM D	11 FF
IMM U	22 FF
IMM D	21 FF
OMM RT	40 FF

Setting the System Operating Parameters

This section contains instructions for viewing and changing parameters in Communication Setup, Channel Configuration, and Input/Output Calibration of the CCS.

It is recommended that before the modules of your CCS are deployed to field operation, the Communication Setup, Channel Configuration, and Input/Output Calibration of the channels on each module be verified and recorded.

A laminated Configuration Record card is packed with each System module inside the bottom storage compartment for recording changes.

As with the Bench Check, it is recommended that the procedures in this section be performed at a technician's bench or in a similar laboratory setting. In fact, the same setup from the Bench Check may be used for verifying or changing System parameters in this section. See Figures 7 and 10.

Although Communication Setup, Channel Configuration, and Input/Output Calibration ***can*** be checked or changed once the System has been installed, you may find it easier (and safer) to effect changes isolated from your process or application.

Figure 9 presents an overview of the CCS Menu System. Representations of the front panel pushbuttons are used to indicate paths through the menu.

Actions/Buttons Not Shown. Pressing front panel pushbuttons not depicted in the menu flow charts have no effect on the display or menu.

For example, SELECT, DOWN, and UP are not shown on the Module Type/Firmware Version Display depicted in Figure 9. Pressing any of these buttons at this point in the program causes the unit to emit a single beep. It does not effect a movement through the menu.

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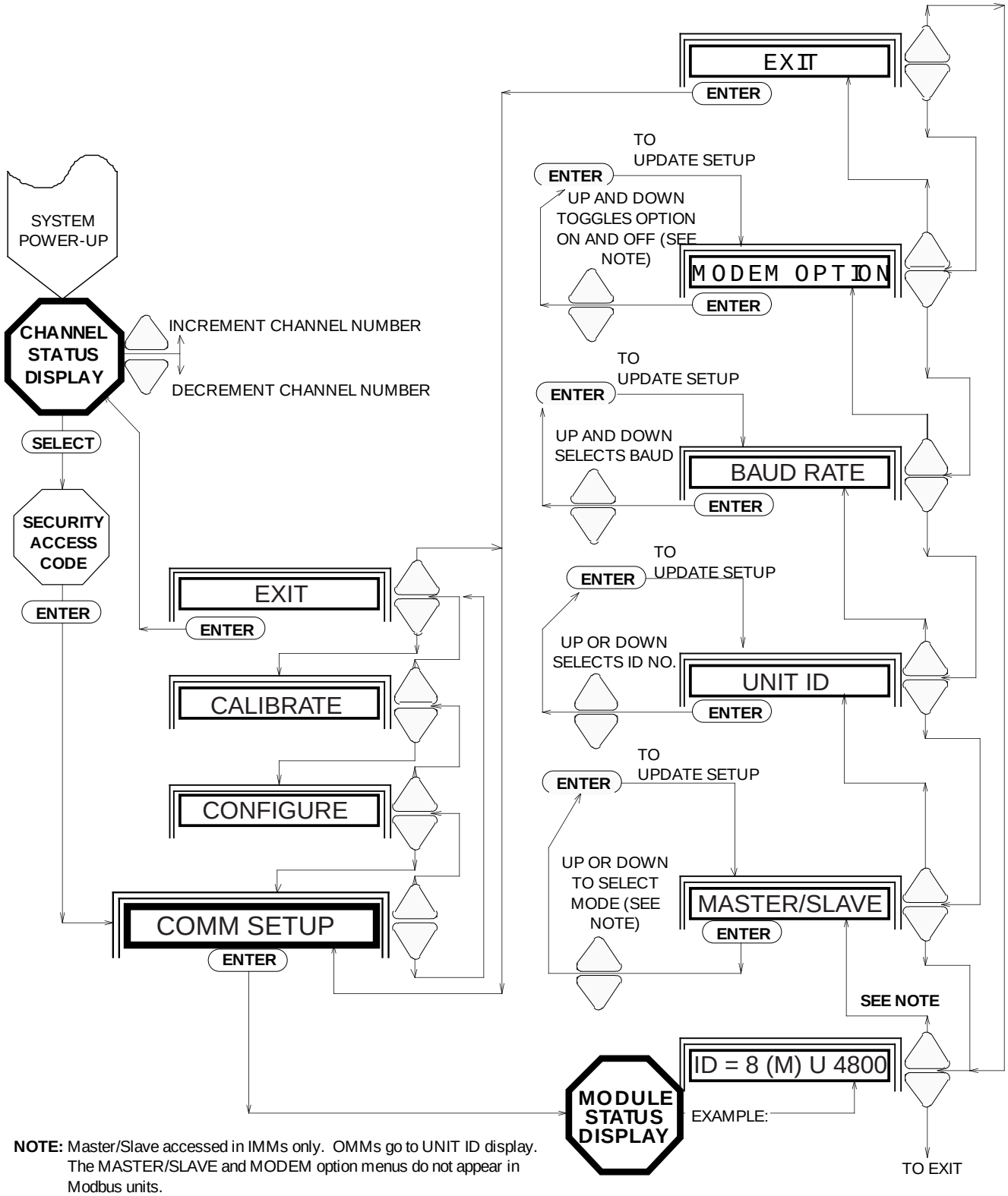
Figure 9. *CCS Menu Overview*



NOTE: Master/Slave accessed in IMMs only. OMMs go to UNIT ID display. The MASTER/SLAVE and MODEM option menus do not appear in Modbus units.

From the Module Type/Firmware Version Display, ENTER is the only pushbutton that will permit access any other point in the menu.

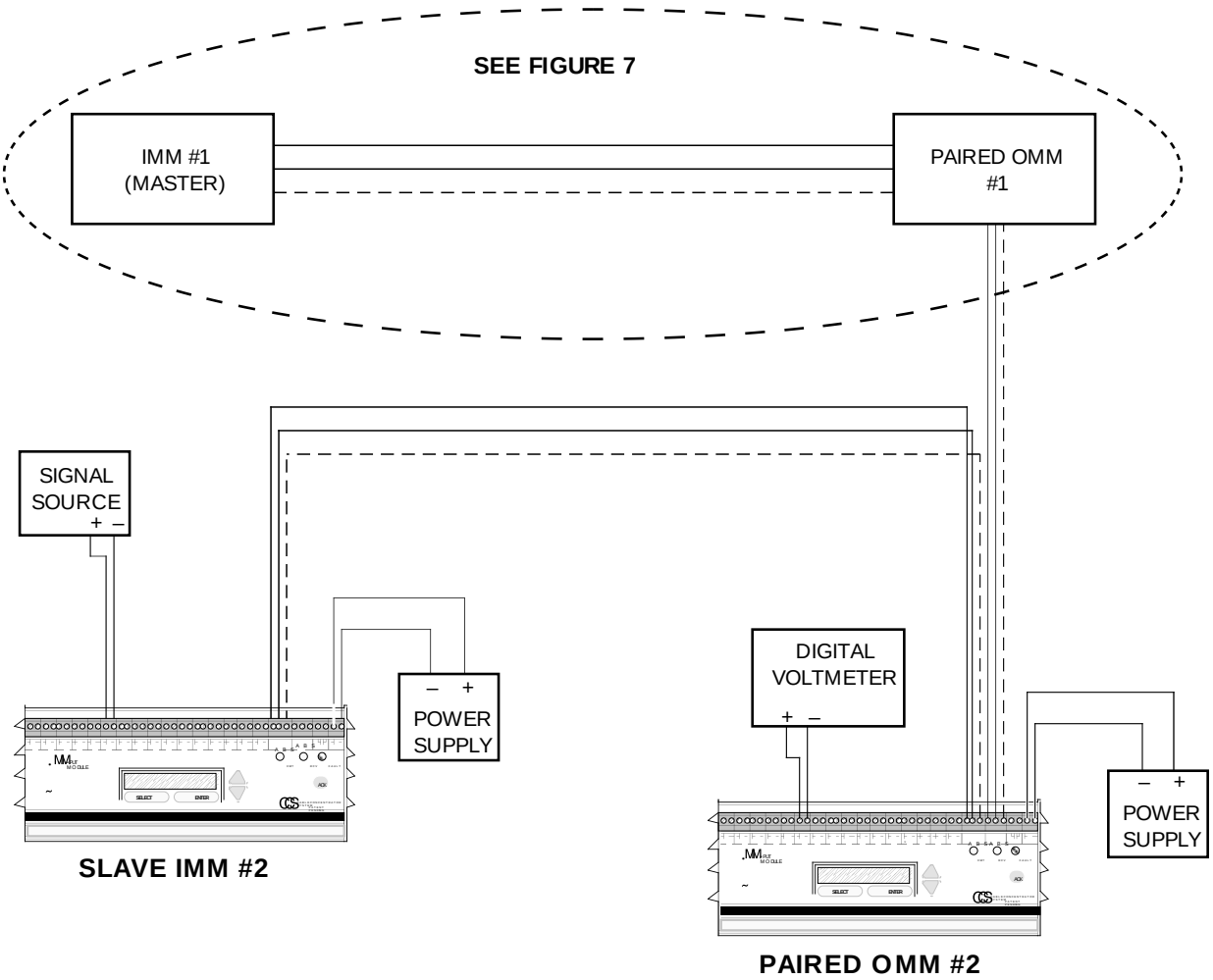
Special ACK Functions. During normal operation and while viewing or changing operating parameters, the "FAULT" LED on the front panel will begin to flash to indicate a problem with the link. If the firmware is at the Channel Status Display point in the menu, pressing ACK accesses the Fault Status portion of the System Menu.

Pressing ACK at any other point in the menu will stop the "FAULT" indicator's flashing; causing it instead to glow steadily.

Also, from the Security Access Code display, pressing ACK then ENTER ***before*** entering the correct code will bring up the Fault Status portion of the System Menu.

Units with MBR option. Every IMM and OMM Channel will have a register (one word) associated with it. The IMM has input registers and the OMM has holding registers. These registers will be addressed 0-15 for channels 1-16 respectively.

Figure 10. *Setting Up to Bench Check Slave IMMs*



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The IMM and the OMM will also have 16 discrete registers addressed 0-15. These registers will be used in the IMM to read the status of the discrete input channels (Read Input Status, command #02) and in the OMM to set the discrete output channels (Read Coil Status, command #01, Force Single Coil, command #05, Force Multiple Coils, command #15). These registers are packed as one input or output per bit of the data field. (See the Operation section of the manual for the data format for discrete channels.) The Least Significant Bit (LSB) of the first data byte contains the input addressed in the query. The other inputs follow sequentially to the end of this byte, and from low order to high order in subsequent bytes.

An additional holding register at address 32 will hold the IMM/OMM fault conditions. Reading holding register 32 (command #03) allows the host to read the status of the IMM/OMM communications. Writing to register 32 (command #06) allows the host to acknowledge and/or clear the exception (fault) flags.

The fault acknowledge and clear functions available from the front panel and display operate the same in Modbus and non-Modbus systems.

CCS Modbus Commands The Modbus commands implemented in the CCS are shown in Tables 7 and 8.

Displaying Module Type/ Firmware Version

The first system parameter to check in your CCS is the type of module and the version of the firmware installed.

Table 7. *Modbus Commands for the IMM*

Code	Name	Description
02	Read Input Status	Reads the state (ON/OFF, HI/LO) of the discrete inputs of the IMM (Registers 0-15)
03	Read Holding Register	Reads the levels of the analog inputs of the IMM (4XXXX). It also reads the IMM communications status. (Holding register 32)
04	Read Input Register	Reads the levels of the analog inputs of the IMM (3XXXX).
06	Preset Single Register	Write to holding register 32 to acknowledge and clear fault conditions.
17	Report Slave ID	Returns a description of the IMM (UIMM, DIMM...)

Table 8. *Modbus Commands for the OMM*

Code	Name	Description
01	Read Coil Status	Reads the state (HI/LO, ON/OFF) of the discrete outputs (CC, RELAY) of the OMM (Registers 0-15).
03	Read Holding Register	Reads the level setting of the OMM analog outputs (4XXXX). It also reads the OMM communications status (holding register 32).
05	Force Single Coil	Changes the state of a single discrete output to ON or OFF (Registers 0-15).
06	Preset Single Register	Changes the level of a single analog output (4X). It also writes to holding register 32 to acknowledge and clear fault conditions.
15	Force Multiple Coils	Changes the state of multiple discrete outputs to On or OFF (Registers 0-15).
16	Preset Multiple Registers	Changes the level of multiple analog outputs (4XXXX).
17	Report Slave ID	Returns a description of the OMM (UOMM, ROMM, TOMM...)

This manual is intended for use with CCS modules using Moore Industries' Version 1.7 (and above) of the Universal and Discrete IMM, the Universal OMM, the version of the Discrete OMM not fitted with miniature power relays (the DOMM) and units with Modbus software. Texts and figures also apply to the Discrete OMMs using version 1.0 (and above) of the firmware for modules equipped with power relays, or using the power relay pc board.

These programs were first installed in units with serials numbers of 707795. Instructions and descriptions in the following sections may not apply to Systems using earlier firmware releases.

To check the firmware version, refer to Figure 9. Apply the appropriate power to the System, and after the CCS modules execute a brief self-check, the first steady display to come up on the LCDs is the Channel Status Display.

To check the firmware version:

1. **From the Channel Status Display, press ENTER.**

   Listen for the tone that confirms instruction receipt. As shown in figure 9, the LCD will show the Module Type/Version Display. An example follows.

UIMM = The Module Type (UIMM, UOMM, DIMM, DOMM, or RTOMM) will appear.

V1.7 = The version of Moore Industries' proprietary System firmware installed; 1.7 or higher for all but RTOMMs and Modbus, for which 1.0 or higher will appear. A Modbus example follows.

2. **Press ENTER once again. The display will return to the Channel Status Display.**

NOTE:
If your modules do not bring up the displays described here, you may be using the wrong user's manual. Contact Moore Industries' Customer Service Department for assistance.

Entering the Security Access Code

To register changes to any of the parameters in the System Menu, the user must enter the Security Access Code. This extra step is provided to help avoid accidental or unauthorized changing of operating parameters, which could result in false readings or erroneous indications.

Figure 11 illustrates the procedure for bringing up and entering the Security Access Code.

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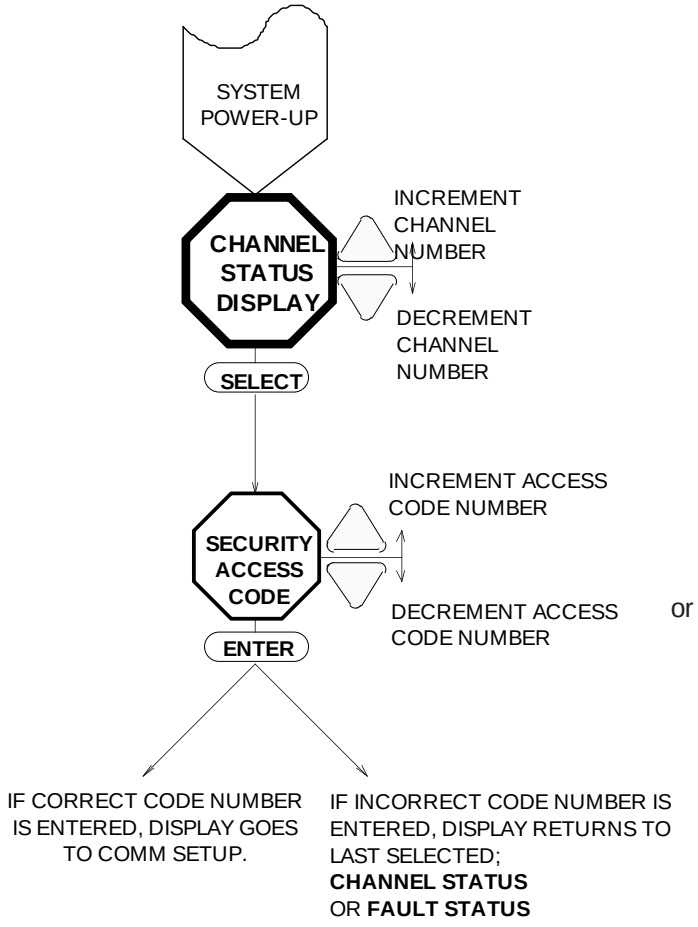
Figure 11. *The CCS Security Access Code*


SYSTEM POWER-UP
CHANNEL STATUS DISPLAY
INCREMENT CHANNEL NUMBER
DECREMENT CHANNEL NUMBER
SELECT
SECURITY ACCESS CODE
INCREMENT ACCESS CODE NUMBER
DECREMENT ACCESS CODE NUMBER
ENTER
IF CORRECT CODE NUMBER IS ENTERED, DISPLAY GOES TO COMM SETUP.
IF INCORRECT CODE NUMBER IS ENTERED, DISPLAY RETURNS TO LAST SELECTED; CHANNEL STATUS OR FAULT STATUS

To enter the Security Access Code:

1. **From the Channel Status Display, press SELECT.**
   The Security Access Code Display will appear.

2. Press UP or DOWN until display shows 07. The display can read 00 through 99.

NOTE:
The Security Access Code cannot be changed by the customer.

3. **Press ENTER.**
   The first level of the CCS menu is now accessed. From here, pressing UP or DOWN accesses:

COMM SETUP

CONFIGURE

CALIBRATE

or

EXIT

4. **Press ENTER from any of these displays to access the appropriate sub-menu or, in the case of "EXIT", to return to the Channel Status Display.**

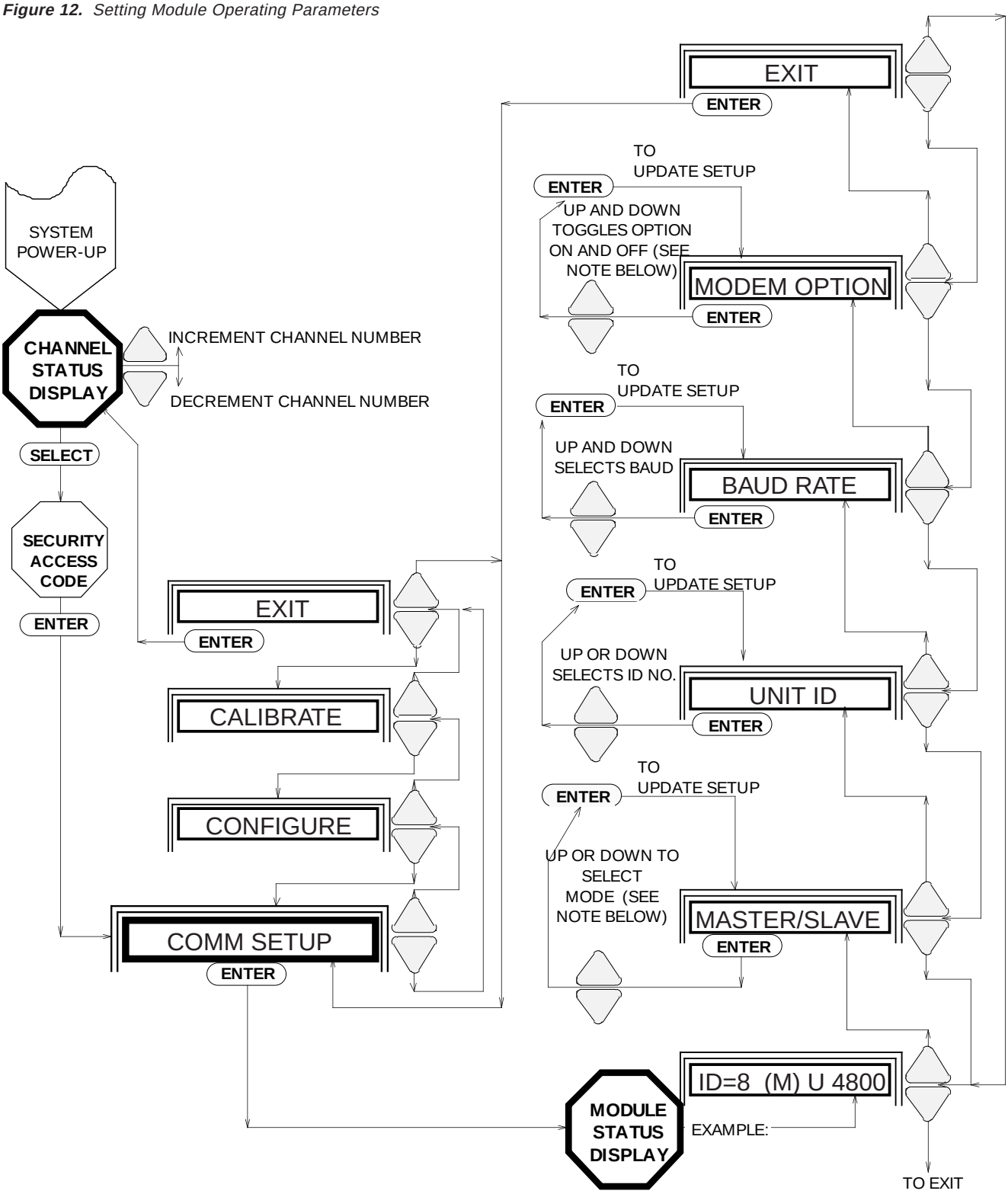
The Communications Setup

This portion of the menu system, referred to as the **COMM SETUP**, controls module-related operating parameters. Figure 12 gives an overview.

In COMM SETUP, it is possible to:

- Set MASTER/SLAVE (IMMs only).
- View or change the UNIT ID.
- View or change the BAUD RATE.
- Enable or Disable the Module's ability to interface with an external MODEM. (Not applicable to Modbus units)

Figure 12. *Setting Module Operating Parameters*



NOTE: MODBUS UNITS DO NOT SHOW MASTER/SLAVE OR MODEM OPTION SCREENS

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To set module operating parameters:

1. **Enter the Security Access Code.**
2. **Check for the following display:**

3. **Press ENTER.**
   The LCD will show the Module Status Display:

ID=1 is the module's ID number in the System; **1-8** are possible. Modbus units can have **1**-**99**.

(M) is the designator for Master IMMs. An **S** denotes an IMM configured as a slave, and an **O** appears in the display for an OMM. Modbus units cannot be configured as slaves or masters so the display will be blank in this location.

U is for Universal. A **D** would signify a Discrete module. Modbus units will have either **IMM** or **OMM** displayed after the U or D.

NOTE:
Modules configured at the factory for Discrete operation cannot be modified to provide universal operation in the field.

9600, is the four-digit number representing the currently selected baud rate. Options for 300, 600, 1200, 2400, 4800, 9600, and 19200 are programmable for non-Modbus units. Modbus units can select from 600, 1200, 2400, 4800, 9600, and 19200.

M signifies that this unit is configured for external modem operation; a blank space in the last character of the Module Status Display means NO MODEM. Modbus units will always display the modem option.

Selecting MASTER/SLAVE

NOTE:
Skip this section for OMMs and Modbus units.

Earlier versions of the CCS IMM used an internal jumper to control the unit's functioning as a MASTER or SLAVE. The System described in this manual allows the user to set the IMM using the following portion of the Communications Setup.

In older hardware that has been retrofitted with the new firmware, any Master/Slave jumper setting will be overridden by the selection in the menu.

NOTE:
*In multi-module Systems, one (and only one) of the IMM's **MUST** be configured as a Master, and the other IMMs as slaves.*

To select Master or Slave:

1. **From the Module Status Display, press UP or DOWN until the following is displayed.**

2. **Press ENTER, then press UP or DOWN to toggle the IMM between Master and Slave configurations.**
3. **When the desired setting is displayed, press ENTER again. The setting of the module will be updated according to your selection, and the display will return to:**

4. **Press UP or DOWN to access EXIT, or the next desired sub-menu, then press ENTER.**

Selecting UNIT ID

The Unit ID is the number of the module in the System. Each IMM/OMM pair must be given the same ID number in order to establish communications. For example, the signals input to IMM#3, whether it is a Master or a Slave in the System, will be available only at the appropriate channels of OMM#3.

NOTE:
The Modules in each IMM/OMM pair in a System must be configured with the same Module ID#.

To select unit ID:

1. **From the Module Status Display, press UP or DOWN until the following appears on the LCD:**

2. **Press ENTER, then UP (increment) or DOWN (decrement) to select the ID Number of the module, according to your application's needs. Modbus units ID Numbers can range from 1-99. Non-Modbus units ID Numbers can range from 1-8.**

The display will look similar to this:

8 is the selected Module ID Number. **1** is the default Module ID Number.

3. **Press ENTER. The setting of the module will be updated according to your selection, and the display will return to:**

4. **Press UP or DOWN to access EXIT, or the next desired sub-menu, then press ENTER.**

Selecting BAUD RATE

To select the baud rate:

1. **From the Module Status display, press UP or DOWN until the Baud Rate display appears.**

2. **Press ENTER, then use UP or DOWN to select the desired baud rate (UP to increment, DOWN to decrement).**

The available baud rates are:

300, 600, 1200, 2400, 4800, 9600, and 19200

NOTE:
The Baud Rate setting of all modules in the CCS must be the same. A Baud Rate setting of 300 is not available with Modbus units.

3. **Once the desired rate setting is displayed, press ENTER. The setting of the module will be updated according to your selection, and the display will return to:**

4. **Press UP or DOWN to EXIT, or the next desired sub-menu, then press ENTER. The module will transmit and receive at that rate.**

Selecting the MODEM OPTION

To select the modem:

Note:
Skip this section if your CCS unit has the Modbus option. Modbus equipped units cannot turn the modem off.

1. **From the Module Status display, press UP or DOWN until the Modem Option display appears.**
2. **Press ENTER to access the selection screen. UP or DOWN toggles the option on and off.**
3. **Once the desired option setting is displayed, press ENTER. The setting of the module will be updated according to your selection, and the display will return to:**

4. **Press UP or DOWN to access the next desired submenu, or EXIT.**

Exiting COMM SETUP

Repeatedly pressing DOWN from the Module Status Display will eventually bring the display to **EXIT**. Pressing ENTER from this screen will return you to COMM SETUP display (see figure 12).

From COMM SETUP, UP and DOWN will now move you to the other menus.

Configuring Channels

The next sub-menu allows the user to view or change the configuration of each channel in a module. Depending upon the hardware, you can set each channel to operate in:

For Universal Modules -
- Contact Closure
- TTL
- Voltage

or
- Current

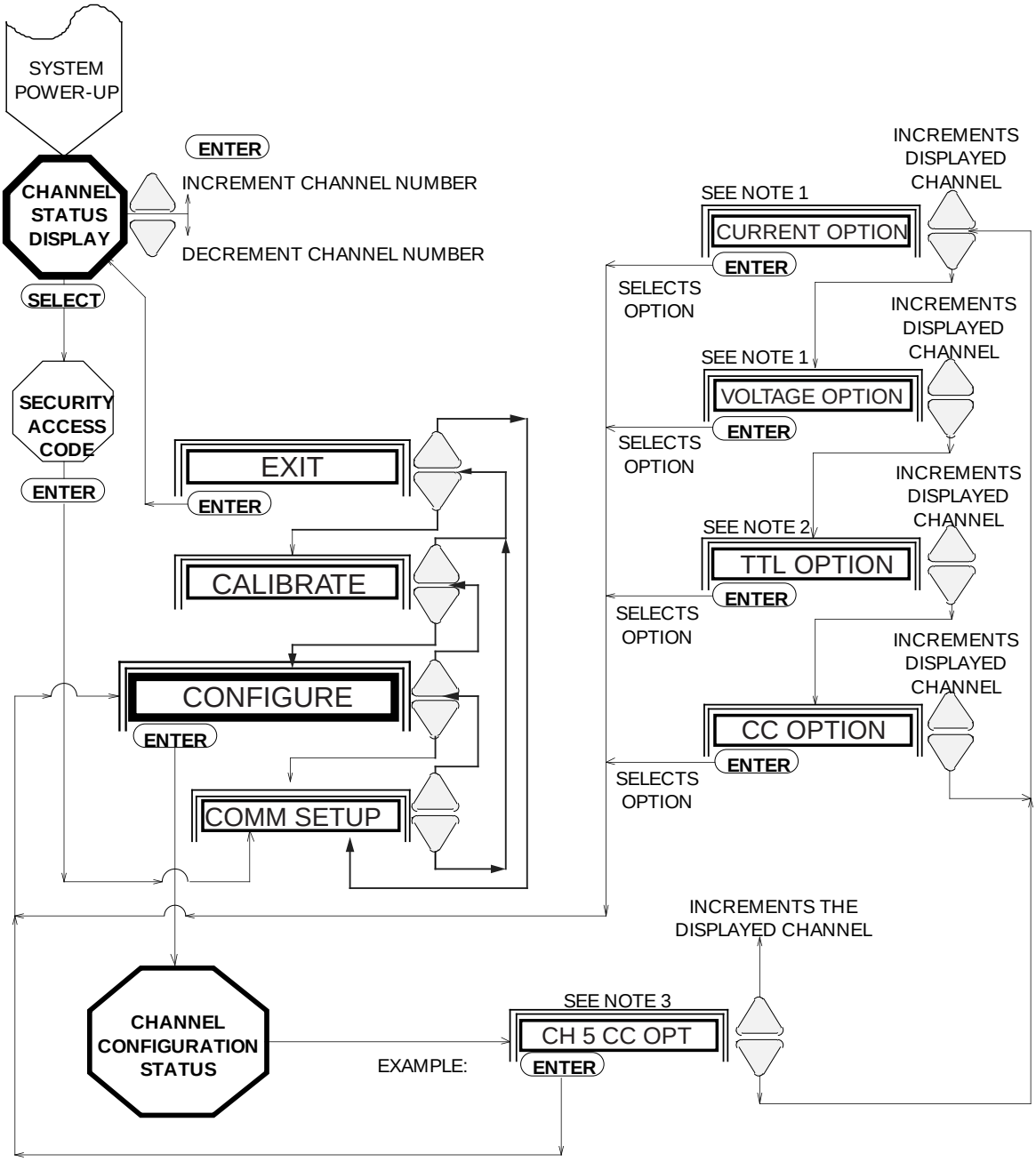
For Discrete IMMs -
- Contact Closure

or
- TTL

TTL output is not available in some types of Discrete OMM. Refer to the Specifications listing in this manual for more information on the factory configuration of Discrete OMMs.

Figure 13 shows **CONFIGURE**.

Figure 13. *Setting the CONFIGURE Parameters*



NOTES: 1. Not available on discrete-configured channels.
2. Not available in versions of the Discrete OMM equipped with relays (ROMM/TOMM).
3. For relay-equipped Discrete OMMs (ROMM/TOMM), all channels display "CC/RELAY". UP increments the channel number, but the only other active pushbutton is ENTER, which returns to CONFIGURE as shown.

To configure the channels:

1. **After power-up, input the Security Access Code.**
2. **Press UP or DOWN until the LCD shows:**

3. **Press ENTER, and the Channel Configuration Status Display will come up. This is an example of a Channel Configuration Status Display:**

The **1** will be the channel number whose configuration status you are viewing or changing; **1** through **16** are available.

CC OPT signifies the Contact Closure setting for this channel.

If yours is a Universal module, the display may show **CC OPT**, **CURRENT OPT**, **VOLTAGE OPT**, or **TTL OPT**.

Discrete IMMs have **CC OPT** or **TTL OPT** available.

Discrete OMMs display **CC OPT**, **TTL OPT**, and in some cases, **CC/RELAY** (ROMM/TOMM).

4. **Press UP to scroll through the channels in your unit. As each channel is displayed, its configuration setting will also come up.**
5. **Press DOWN to change the configuration for the channel displayed.**

NOTE:
Repeatedly pressing DOWN scrolls through the setting options available with your type of module for the channel whose number is being displayed.

6. **Once the desired setting is displayed, press UP to increment the display to the next channel. The option displayed will change accordingly.**

   Record the changes made to each channel's setting on the laminated Configuration Record Card.

Exiting CONFIGURE

When all the channels have been set as desired, press ENTER. The setting of the module will be updated according to your selection, and the display will return to:

Press UP or DOWN to access the next desired submenu, or EXIT.

Converting Outputs

It is possible to convert the signals processed by the modules in your CCS. Current input can be presented as voltage output, and vice-versa. It is suggested that the Module Configuration Record be used to note any converting.

Channel Calibration

This sub-menu is the means by which the user sets the zero and full scale values of analog channels (current and voltage), along with the default value of output signals in the OMM.

From **CALIBRATE**, the user can:

- Set default values or conditions that the output channels assume if the communication link is lost.
- Set current or voltage to any desired value within the range of the signal (refer to the Specifications listing in this manual).
- Invert the outputs of discrete channels and units.

Discrete IMMs, and the discrete-configured channels of Universal IMMs have no options in the calibrate mode. They are input to the IMM as either high or low (for TTL), or opened or closed (for contact closure).

Discrete channels can be set for default conditions in the OMM, but the channels are either on or off.

In the IMM, if a channel which has been configured for TTL or contact closure signals is selected for calibration, the display will read:

NOTES:

Use the setup described in the Bench Check of this manual when executing the Input/Output Calibration procedures.

The last changes made in the calibration mode are retained in memory whenever power is removed from the modules.

Figure 14 illustrates the CALIBRATE procedures for IMMs.

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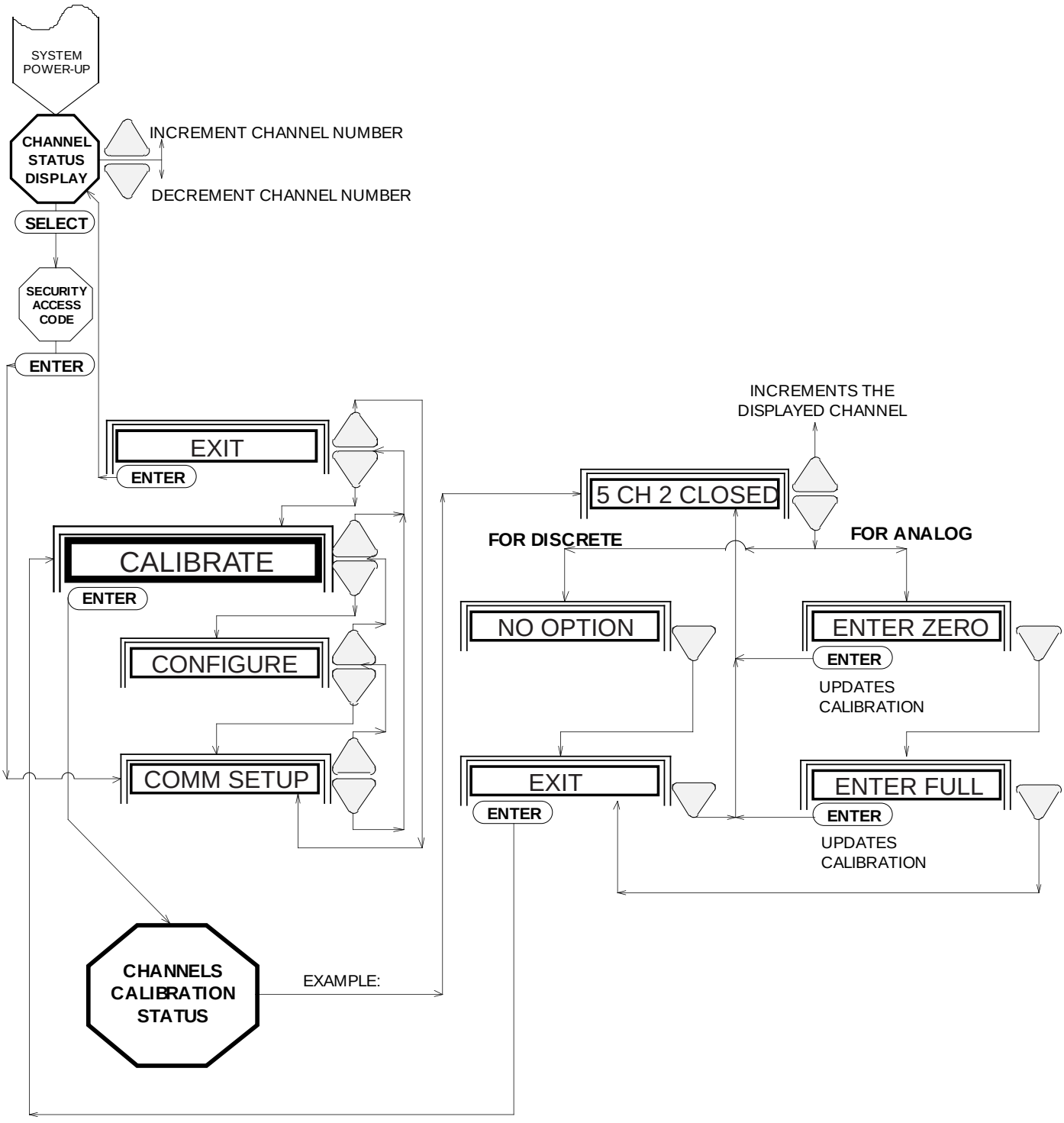
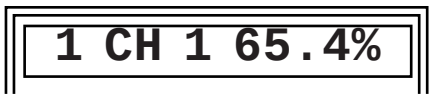
Figure 14. *Calibrating the IMM*



Calibrating Analog IMM Channels

To calibrate Analog IMM Channels:

1. **To calibrate current or voltage input channels on Universal IMMs, enter the security sequence and increment the main menu to CALIBRATE. Press ENTER. The menu will bring up the Channel Calibration Status Display. For example:**



On your unit, the **1** represents the module ID number (1 through 8 or 01 through 99 for MODBUS units); **CH 1** is the channel number (1 through 16); and **65.4%** represents the input signal as a percent of span (discrete channels display HIGH, LOW, OPEN or CLOSED).

2. **Press UP to scroll through channels.**

3. **To view the calibration options for the displayed channel, press DOWN. The display should show:**

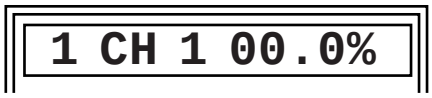
If it shows:

then this channel has been configured for discrete operation.

   a. **To access the display for other channels, return to the Channel Calibration Status Display. Press DOWN (to EXIT), then DOWN again, then go to Step 2 of this procedure.**

4. **Set the analog input signal to zero percent of span. Press ENTER.**

   The zero value is based on the input value present at the terminals when ENTER is pressed. The display returns to the Channel Calibration Status Display. It will show, for example:



5. From the Channel Calibration Status Display, press DOWN twice; the display will show:

6. **Set the analog input signal to the full scale value, and press ENTER.**

   The full scale value is based on the input value present at the terminals when ENTER is pressed. The display will return to the Channel Calibration Status Display.

7. **To calibrate another analog channel, press UP until the desired channel is displayed and repeat steps 3 - 6.**

NOTE:
The Full Scale value should always be higher than the Zero value.

Calibrating Universal OMM Channels

Figure 15 shows the procedure to calibrate universal OMM channels. To calibrate current or voltage output channels, enter the Security Access Code and press DOWN until the CALIBRATE display appears, then press ENTER. The menu will bring up the Channel Calibration Status Display.

To calibrate universal OMM channels:

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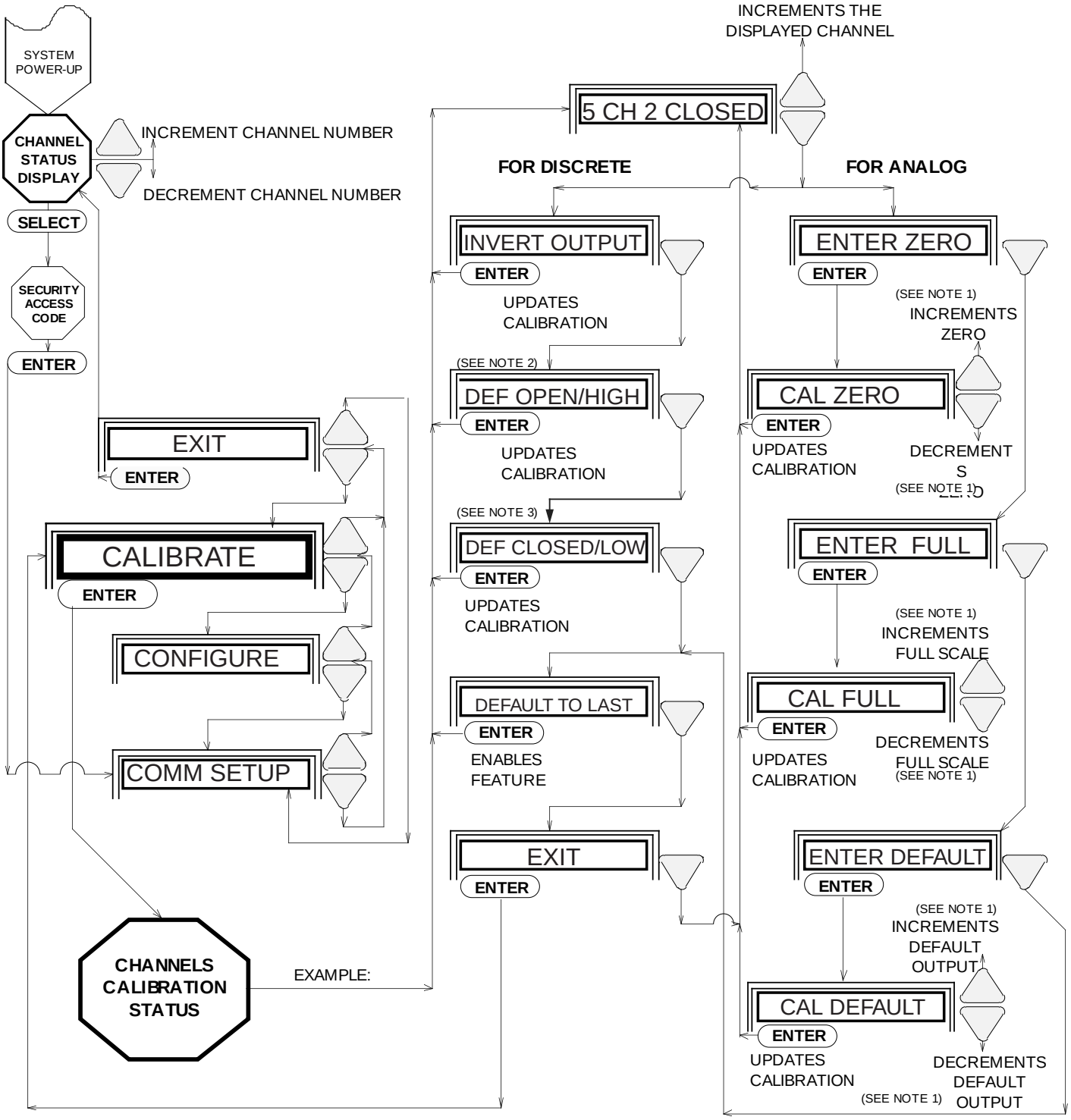
Figure 15. *Calibrating the OMM*



NOTES: 1. Pressing ACK and UP or DOWN simultaneously speeds the rate of display change.
2. For power relay-equipped Discrete OMM, display reads “DEF OPEN”.
3. For power relay-equipped Discrete OMM, display reads “DEF CLOSED”.

1. **Press DOWN to scroll through calibration options for channel displayed. One of the following five options will appear:**

Press down until the option you wish to access is displayed on the screen. Press enter.

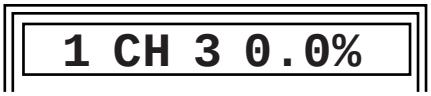
2. **To set zero, press ENTER when ENTER ZERO is on the LCD. The display will show:**

3. **Monitor the output channel being calibrated with a meter. Press UP or DOWN to set zero value to the desired level.**

NOTE:

In the calibrate mode, pressing ACK simultaneously with UP or DOWN while setting the zero or full scale values accelerates the display's change.

4. **When the measured value is at the desired level, press ENTER. The value will be updated in your module, and the display will immediately show, for example:**



The digital meter will show that the desired level, corresponding to 0% of span, is being output at the terminals. To set full scale, continue. If done calibrating channels, skip to "Exiting Channels Calibration" section.

5. **To set full scale value, press DOWN twice. The display will show:**

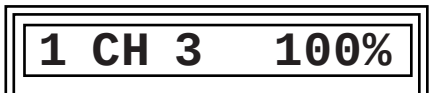
6. **Press ENTER. The display will show:**

7. **Using the appropriate meter, monitor the output, and press UP or DOWN to set full scale value to desired level.**

NOTE:

In the calibrate mode, pressing ACK simultaneously with UP or DOWN while setting the zero or full scale values accelerates the display's change.

8. **When the measured value is at the desired level, press ENTER. The value will be updated in your module, and the display will immediately show 100% of input span. For example:**



9. **To calibrate another analog channel, press UP until the desired channel is displayed. Repeat steps 2 through 8.**

Setting Default Values

With the desired analog channel displayed on the Channel Calibration Status, press DOWN until the display shows:

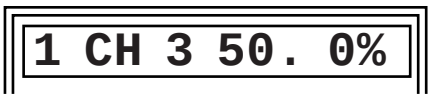
To calibrate default values:

1. **Press ENTER. The display shows:**

2. **Monitor output channel with the appropriate meter, and press UP or DOWN to set the full scale value to desired level.**

NOTE:
In the calibrate mode, pressing ACK simultaneously with UP or DOWN while setting the zero or full scale values accelerates the display's change.

3. **Press ENTER when the correct value is displayed.**
Menu will display, for example:



4. **To set the default value of another analog channel, press UP until desired channel is displayed, then repeat steps 1 through 4.**

Enabling Default to Last

With this feature, the module uses the signal level present at time of communication fault as the default until communications are restored. This is useful for maintaining a "status quo" until the link problem can be fixed.

1. **Press UP until the desired analog channel is displayed.**

2. **Press DOWN until the display shows:**

3. **Press ENTER. The Menu will return to the Channel Calibration Status Display.**

Whenever a link failure occurs, the levels at all channels with the Default to Last parameter "enabled" will be maintained until the communications link is restored.

Until communications are restored, the display and the output will consist of this last value, and include a D to indicate the level being maintained is the default. For example:

```
1 CH 3 25.0% D
```

The FAULT LED on the front panel will also flash. Refer to the Troubleshooting Section of this manual for instructions on clearing alarms.

Upon re-establishment of the link, the System will return to normal operating conditions as determined by the configuration parameters set prior to the link failure.

Calibrating Discrete OMM Channels

As shown in Figure 15, the calibration setting options for Discrete OMMs differ from those for IMMs and Universal modules. This is due to the differences in hardware and firmware in Discrete-type units.

To configure or set channel default conditions for TTL, contact closure, or relay normally open/normally closed:

1. **Enter the Security Access Code and increment the main menu to:**

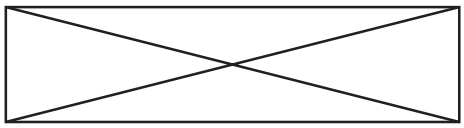
```
CALIBRATE
```

2. **Press ENTER to bring up the Channel Calibration Status Display.**

   For Discrete OMMs with TTL capability, the display will show OPEN/HIGH or CLOSED/LOW. Relay OMM (ROMM and TOMM) displays will show OPEN or CLOSED.

3. **Press UP until the desired channel is displayed.**

4. **Press DOWN to scroll through calibration options for that channel. There are five options:**



```
INVERT OUTPUT
```

```
DEF OPEN/HIGH
```

```
DEF CLOSED/LOW
```

```
DEFAULT TO LAST
```

and finally:

```
EXIT
```

For Discrete OMMs factory-configured with power relays, the following displays are substituted where appropriate:

```
DEF OPEN
```

```
DEF CLOSED
```

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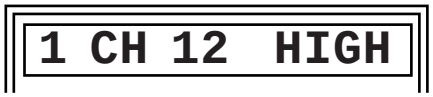
Inverting Output

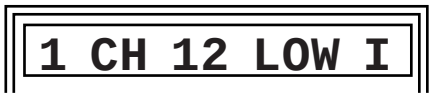
To invert a discrete channel output relative to the input at the IMM, press ENTER when INVERT OUTPUT is displayed. The display will flash the change momentarily.

For example, from channel 12 on the Calibration Status Display of a Discrete OMM, DOWN is pressed until the following appears:

ENTER is pressed, and the LCD shows:



... and then turns to:



TTL, contact closure, and relay normally-open/normally-closed outputs are all inverted in the same manner and can be re-inverted by repeating this procedure.

The display will indicate an inverted output by displaying an **I** in the last field of the Channel Calibration Status Display.

NOTE:
Inverting the output of a discrete channel changes its default condition. This may produce unexpected results unless you are careful to note the relationship of input to output on the Module Configuration Record Card.

Calibrating Discrete Channel Defaults

To program the discrete channels of Universal OMMs or all of the channels of either type of Discrete OMM:

1. **From the Channel Calibration Status Display, press UP until the desired discrete channel is displayed, then press DOWN.**

   If the Discrete OMM is capable of TTL output, the menu will display:

other Discrete OMMs will show:

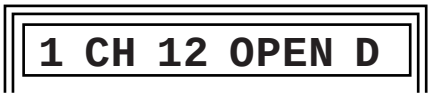
2. **If the default condition is HIGH (TTL channels), or OPEN (contact closure), press ENTER.**
   The menu returns to the Channel Calibration Status Display.

3. **Remove the communication link connector from the OMM and wait for the alarm relay to change state. The FAULT LED will begin to flash.**

   The display will show the default condition, followed by a D.

For example, a TTL could show:

or contact closure could show:



4. **Re-connect the communication link to the OMM; the display returns to normal channel indication.**

5. **In Discrete OMMs capable of TTL output, if the default condition is required to be LOW or CLOSED, from the Channel Calibration Status Display, press UP until the desired discrete channel is displayed, then press DOWN until display shows:**

For relay-equipped Discrete OMMs:

6. **Repeat until all channels are calibrated.**

Exiting Channels Calibration

To exit channel calibration:

1. **From the Channel Calibration Status Display, press DOWN until display shows:**

2. **Press ENTER.**
   The display will show:

3. **Press UP or DOWN to access another sub-menu, or until EXIT is displayed.**
4. **Press ENTER at:**

The module returns to the Channel Status Display.

Installation

Prior to installing the CCS, the system should be bench checked and all necessary channels jumper-configured for the desired inputs and outputs. By bench checking the system first, the user makes the installation process easier. Along with jumper setting, configuration and calibration information can also be entered before the system is mounted and wire connected.

Installation consists of physically mounting the unit and making wiring connections. In most cases, it is easier to mount the CCS before making wiring connections.

Mounting

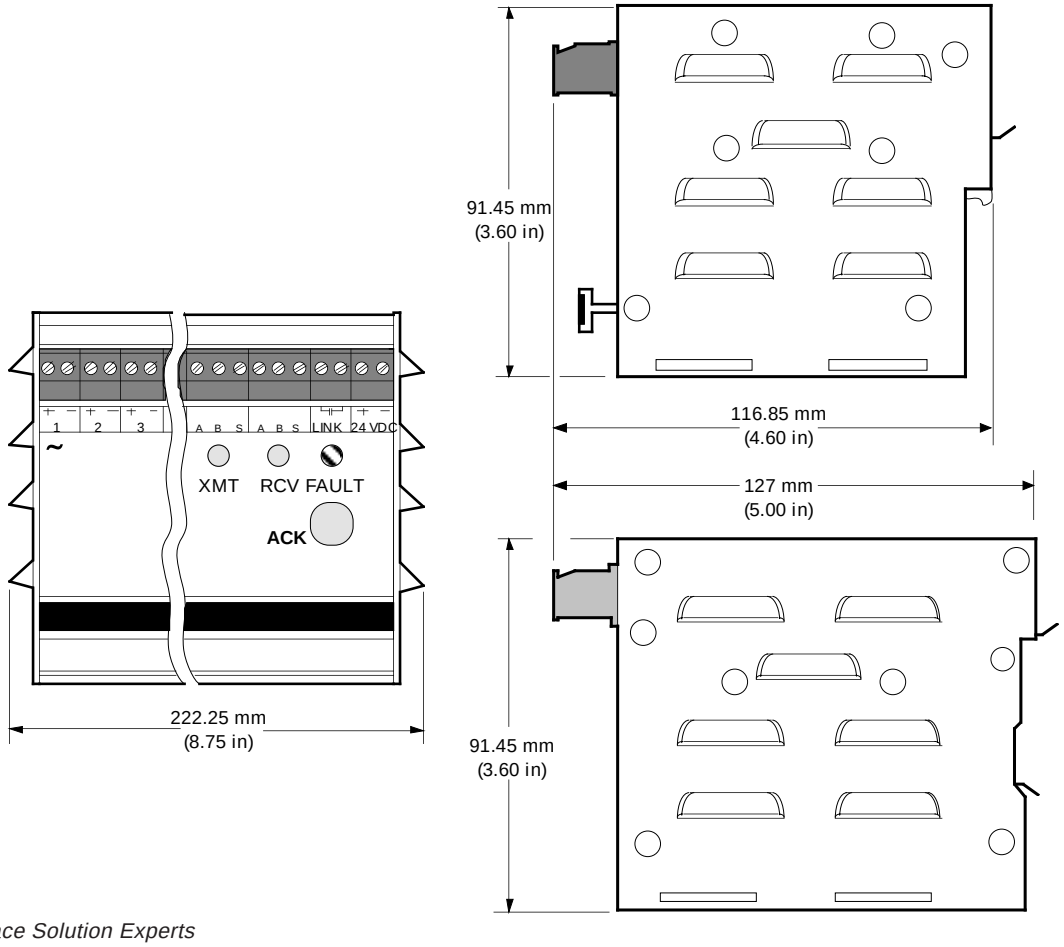
The CCS is packaged in DIN-style aluminum housing that snaps onto 32 mm G-rail (DIN EN50035) or 35 mm hat-rail (DIN EN50022).

NOTE:
The rail that the CCS modules attach to must be grounded for reliable operation.

The modules should be mounted in an area free of excessive dust, moisture and corrosive elements. If a protective enclosure is used, ensure that adequate cooling is provided, and that the LCDs can be easily viewed and pushbuttons reached without hazardous obstructions.

Figure 16 shows the mounting dimensions of the IMM and OMM.

Figure 16. *Dimensions of the CCS*



Wiring Connections

All wiring connections are made with removable terminal plugs that are "shaped" to prevent insertion in the wrong orientation. The terminal plugs accept wire sizes 14 to 30 AWG. A shielded, twisted pair of 24 AWG copper wires is recommended for the communication link.

All terminal plugs can be easily removed and reinserted. Power should be removed from a module before connecting or disconnecting any terminal plugs.

CAUTION:
Ensure that only input or output signals are connected to input/output channels. DO NOT connect DC power to channel terminals; damage will result.

Each CCS set has two LINK terminals. Either LINK terminal can be used to make a single communication link. Each link uses a three-terminal plug, and in each module, each link is electrically identical; pin A is wired to pin A, B is wired to B, and S to S.

To link an IMM to an OMM, a shielded, twisted-wire pair is required and would be connected to terminals A and B with the shield connected to the S terminal at either or both modules. In a multi-IMM connection scenario, or "daisy chain", both terminals are used.

The fault contact terminal has a single two-connector terminal plug for connection to external alarm circuits. Power is supplied to each module via a single two-connector terminal plug.

If the application uses a dc power source, connect the positive (+) power connection to the "+" CCS module terminal and the negative (–) power connection to the "–" CCS module terminal.

Refer to the Ordering Information Table for specifications.

Figure 17 shows a typical hookup diagram for an IMM. Figure 18 illustrates a typical hookup diagram for an OMM. Figure 19 shows a typical hookup diagram for IMMs and OMMs with Modbus.

Input and output devices will vary from those shown in these figures.

Figures 20 through 31 illustrate hookups for systems that use various types of field devices.

These are provided for instructional purposes only. Your field devices and the method of connection may differ.

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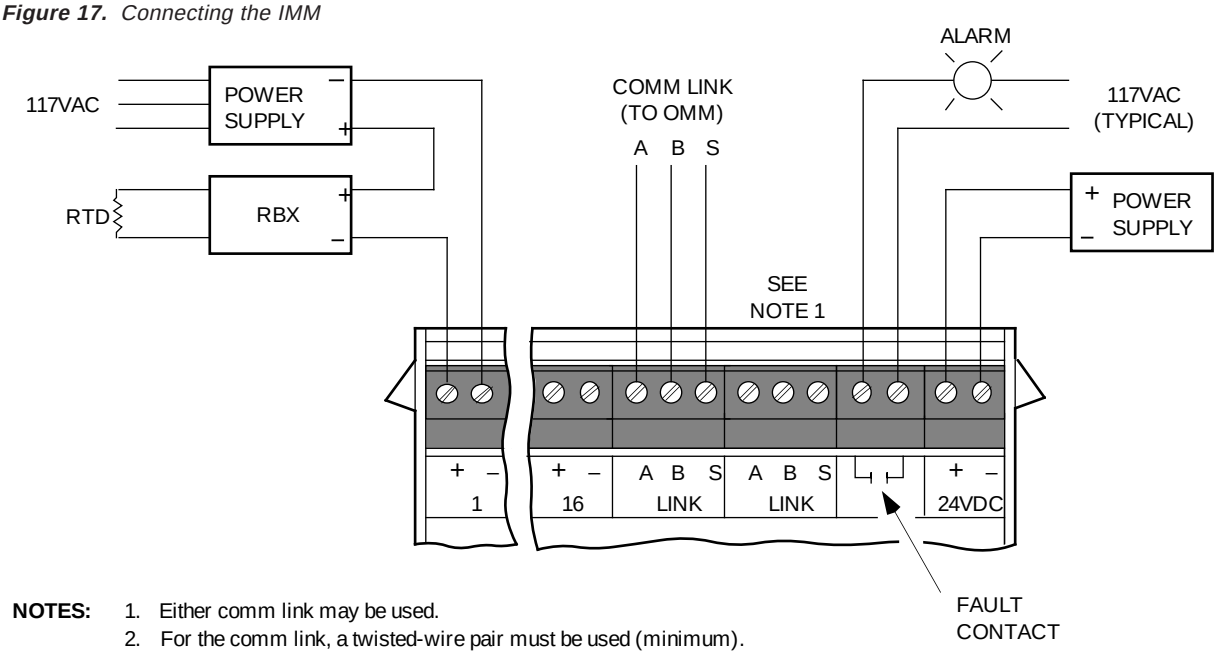
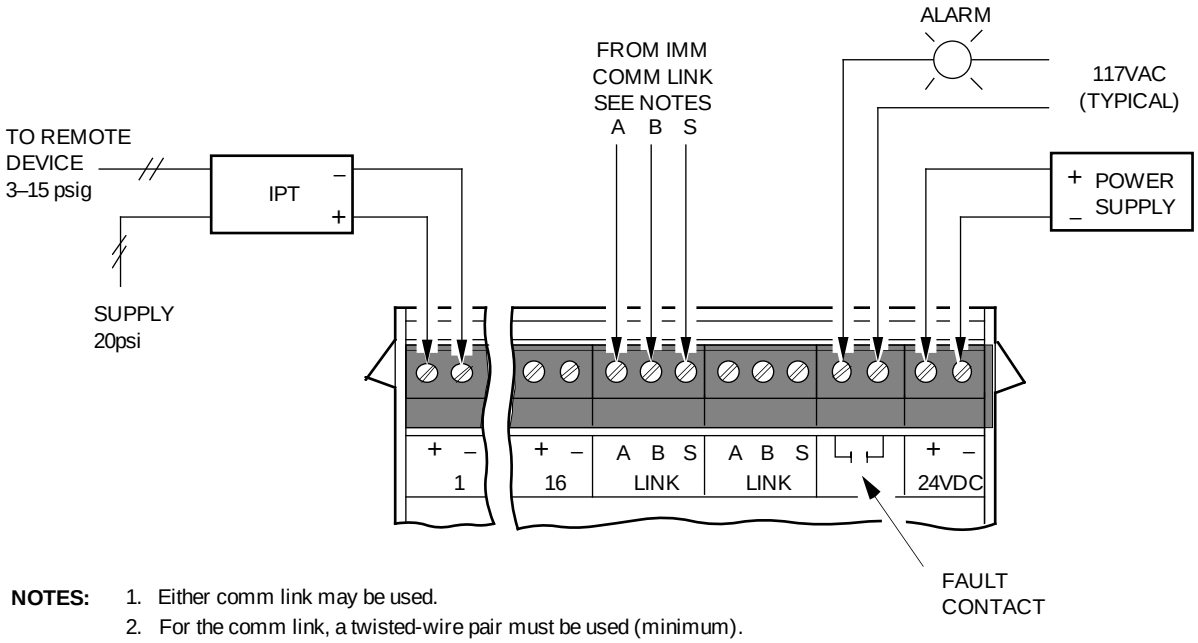
Figure 17. *Connecting the IMM*



NOTES:
1. Either comm link may be used.
2. For the comm link, a twisted-wire pair must be used (minimum). If a shielded twisted-wire pair is used, connect the shield to the "S" terminal at either or both modules.

Figure 18. *Connecting the OMM*



NOTES:
1. Either comm link may be used.
2. For the comm link, a twisted-wire pair must be used (minimum). If a shielded twisted-wire pair is used, connect the shield to the "S" terminal at either or both modules.

Figure 19. *Connecting Multiple IMM and OMM Modules with Modbus*

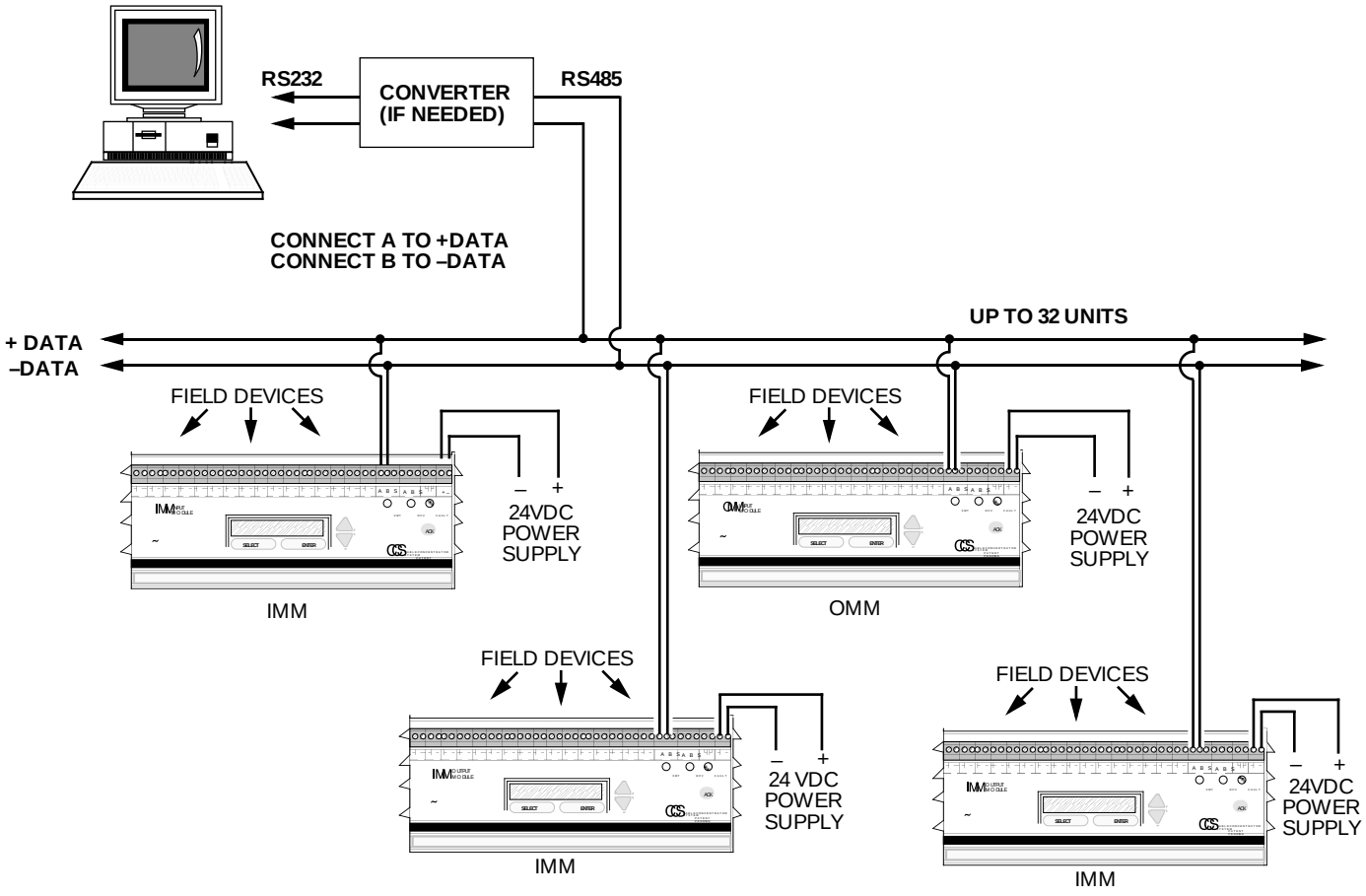


Figure 20. *Connecting IMM Analog Current Input (Loop Powered Field Device)*

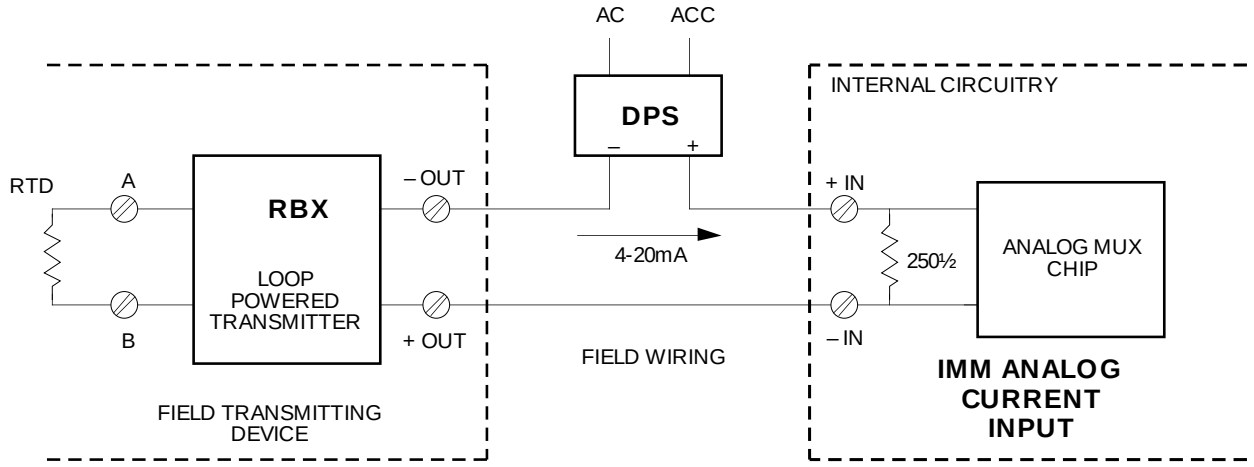


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Figure 21. *Connecting the IMM with Analog Current Input (4-wire Field Device)*

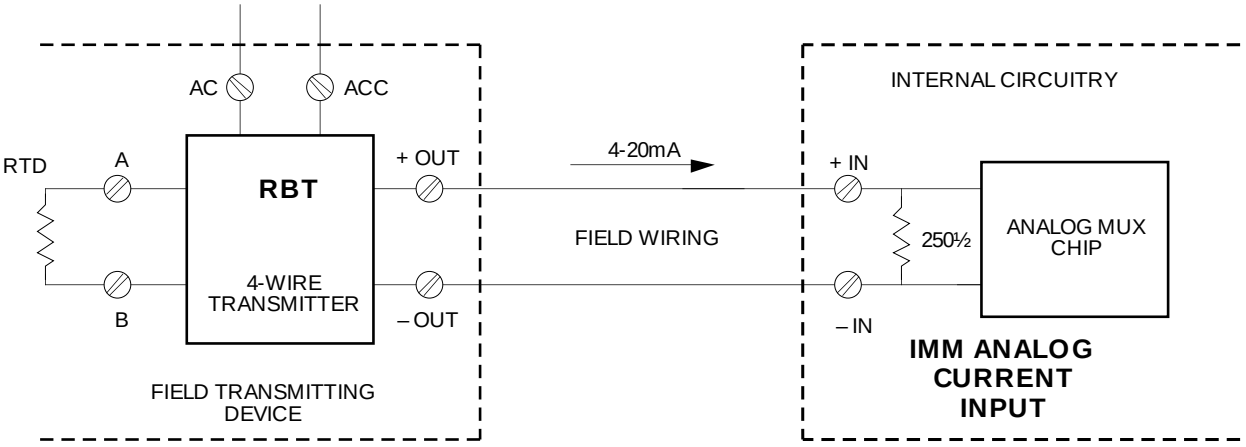


Figure 22. *Connecting an IMM with Voltage Input*

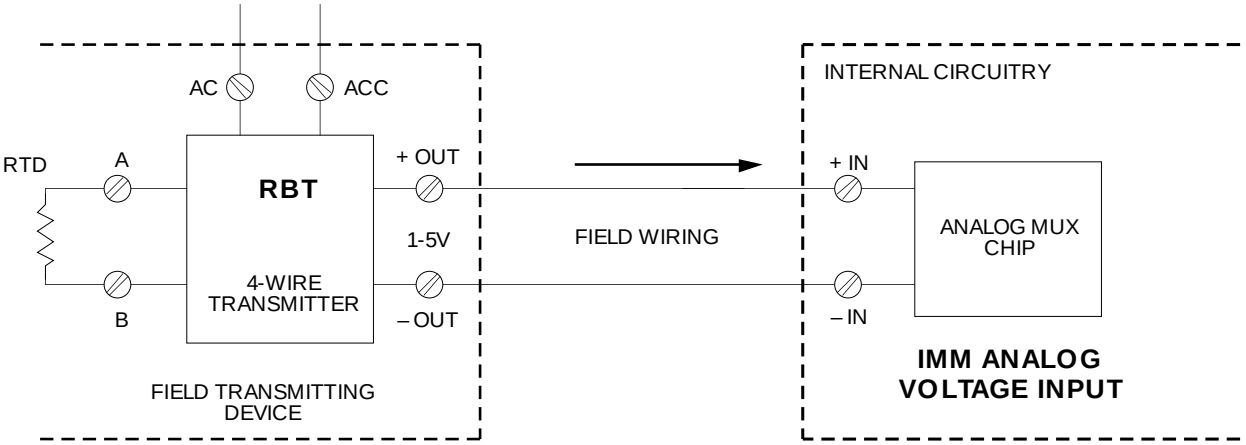
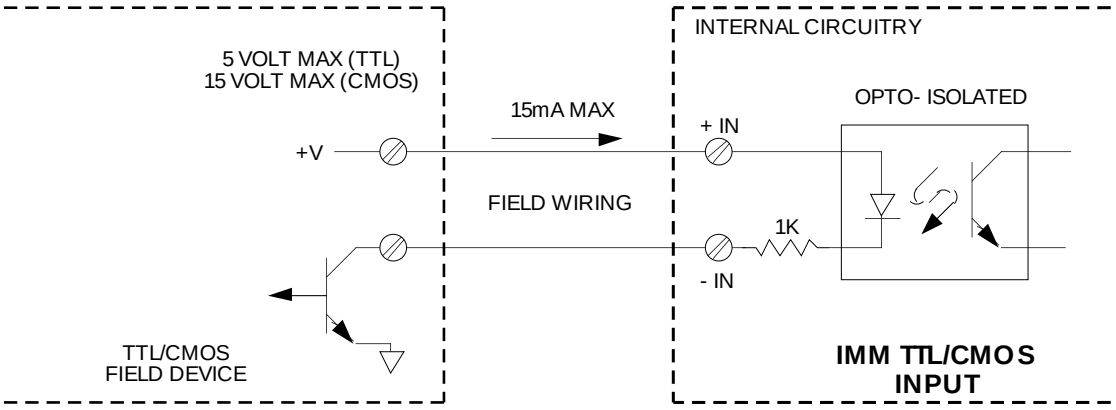
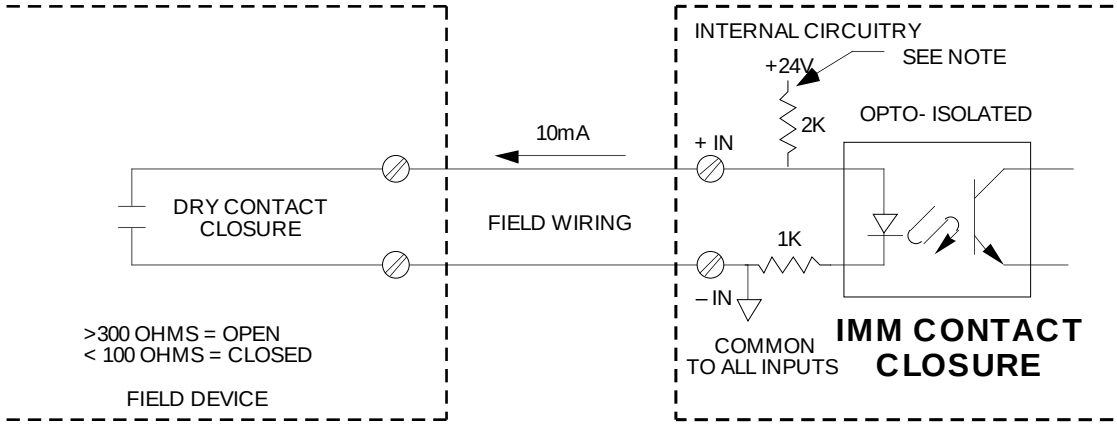


Figure 23. *Connecting the IMM with TTL/CMOS Input*



NOTE: Current output must be limited to 15mA maximum.

Figure 24. *Connecting the IMM with Contact Closure Input*



NOTE: For applications calling for externally-powered contact closure,remove jumper JXC on PC3 of IMM refer to section entitled "Setting IMM Configuration Jumpers"

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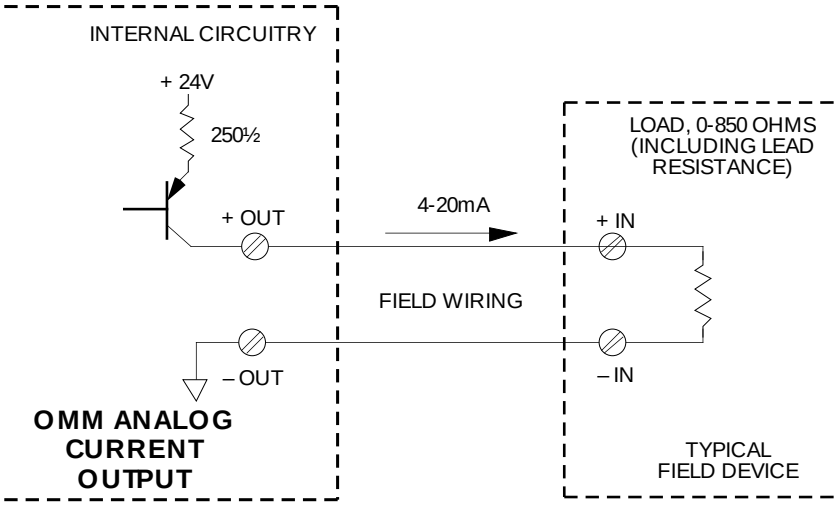
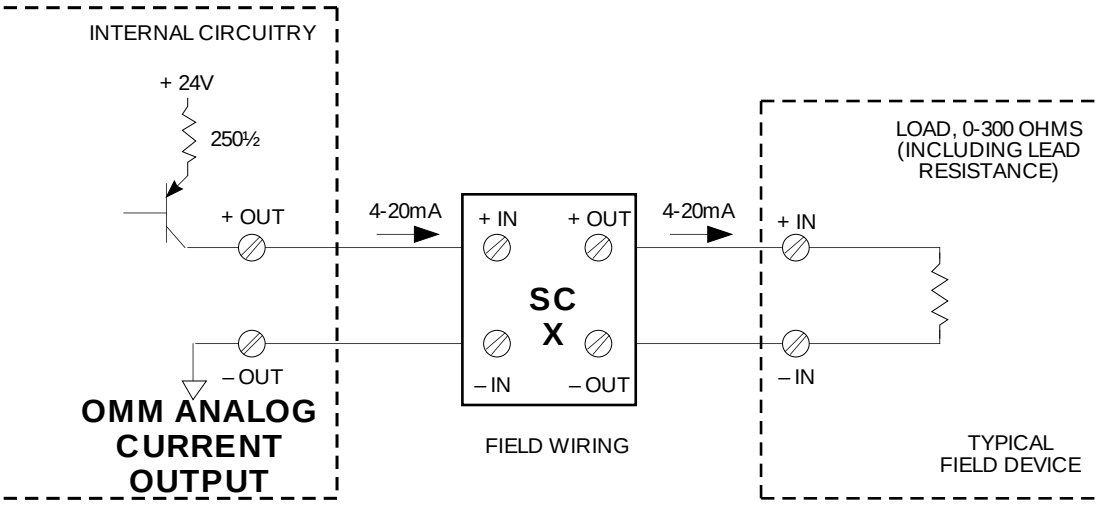
Figure 25. *Connecting the OMM with Current Output*



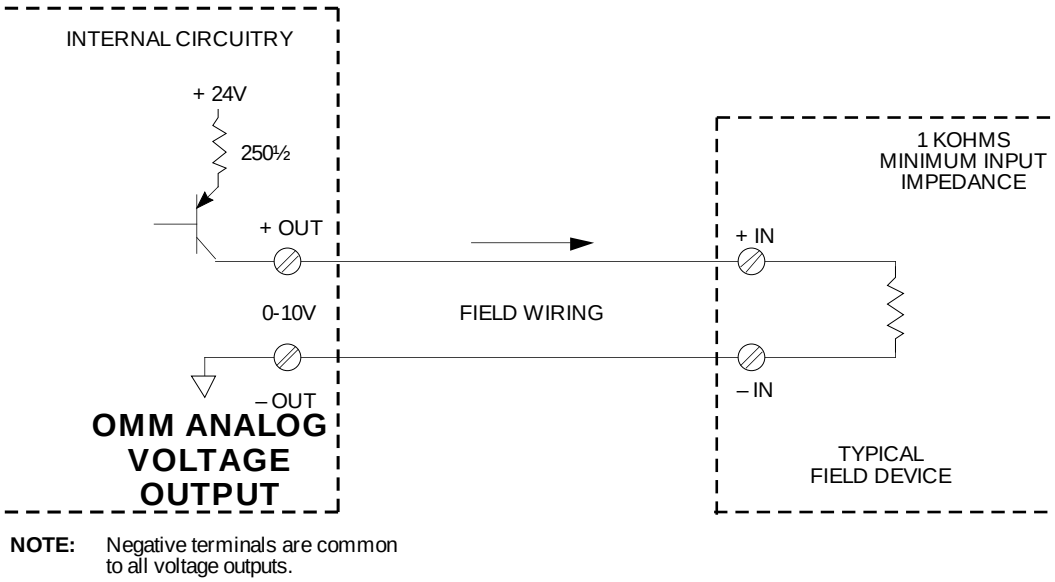
NOTE: Negative terminals are common to all current outputs.

Figure 26. *Connecting the OMM with Analog Output and SCX Isolator*



NOTE: Negative terminals are common to all current outputs.

Figure 27. *Connecting the OMM with Voltage Output*



NOTE: Negative terminals are common to all voltage outputs.

Figure 28. *Connecting the OMM with TTL/CMOS Output*

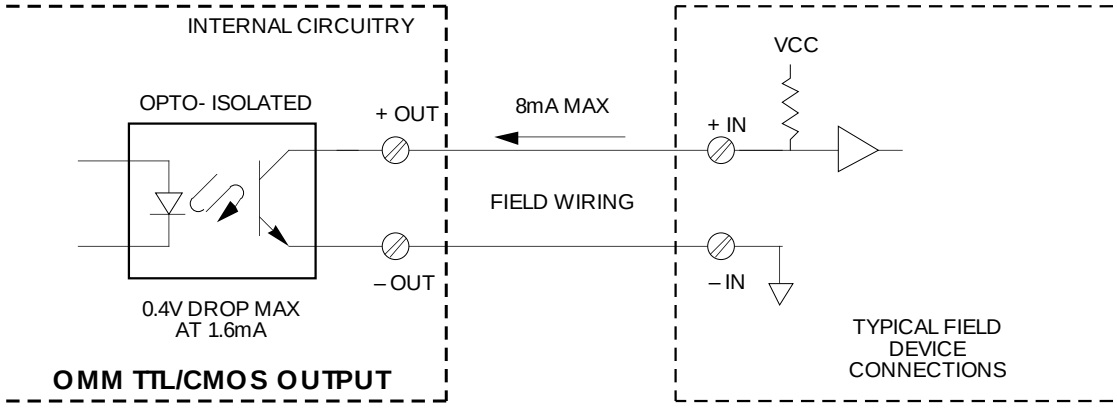


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Figure 29. *Connecting the OMM with Discrete Output*

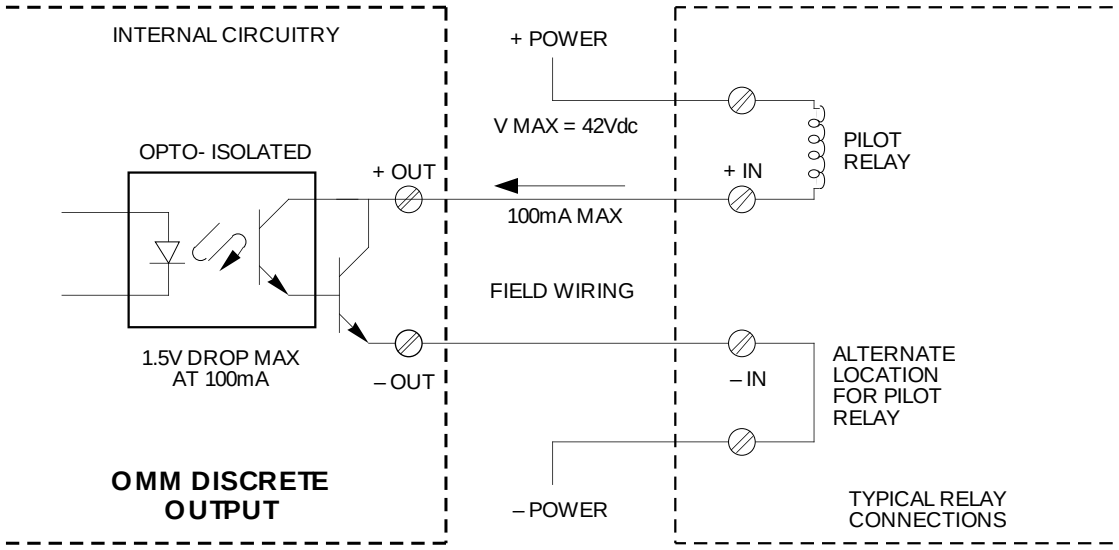


Figure 30. *Connecting the OMM with Relay Output and AC Inductive Load*

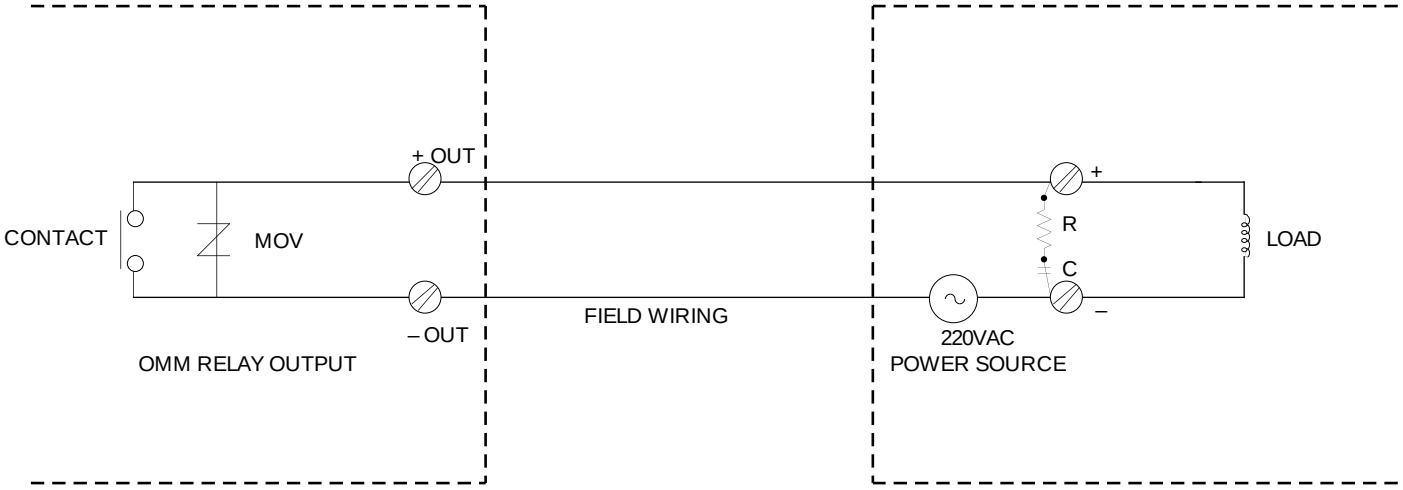
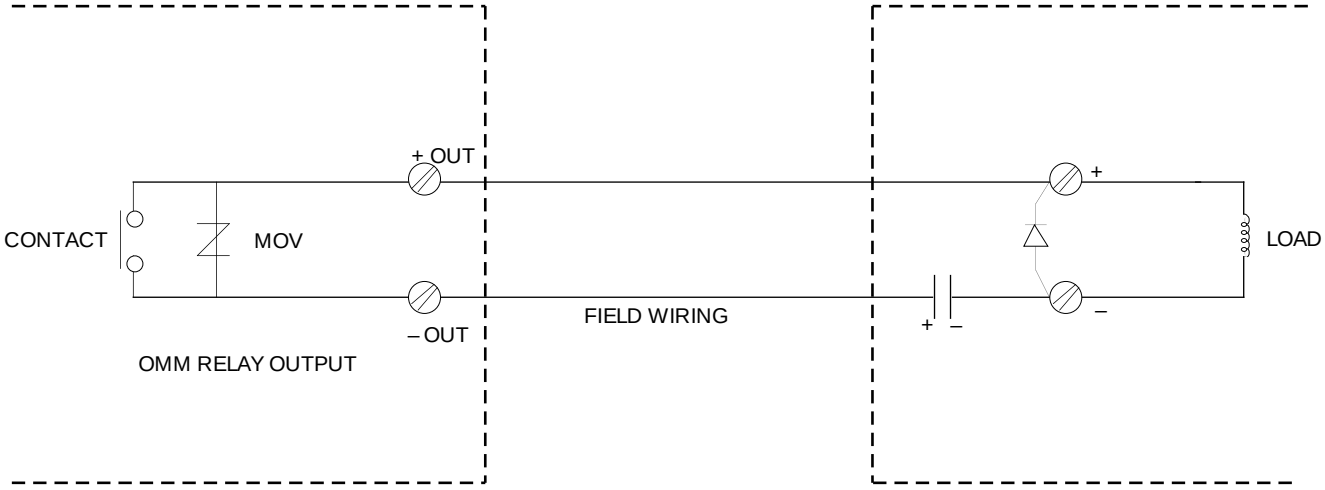


Figure 31. *Connecting a Relay Output OMM with DC Inductive Load*



Figures 32 through 35 illustrate connections utilizing a redundant communication link.

A redundant communication link is a secondary means for exchanging digitized data between IMM and OMM.

Figures 32 and 33 show the recommended hookups for utilizing a redundant communication link. These hookups eliminate the problems that other hookups may have with length and short circuits.

Figure 34 shows a hookup that requires that the length of the secondary link be within ±10 percent of the primary link. An electrical short on either link prevents the system from operating. For this reason, this configuration is not recommended.

Figure 35 illustrates a redundant link incoporating one manual switch, which disconnects the primary link and connects the secondary link. This configuration overcomes the need for the secondary link to be within ±10 percent of the primary. However, an electrical short in this configuration will also prevent the system from operating. This configuration is also not recommended.

Figure 32. *Connecting Dual Manual Switches in a Redundant Communication Link*

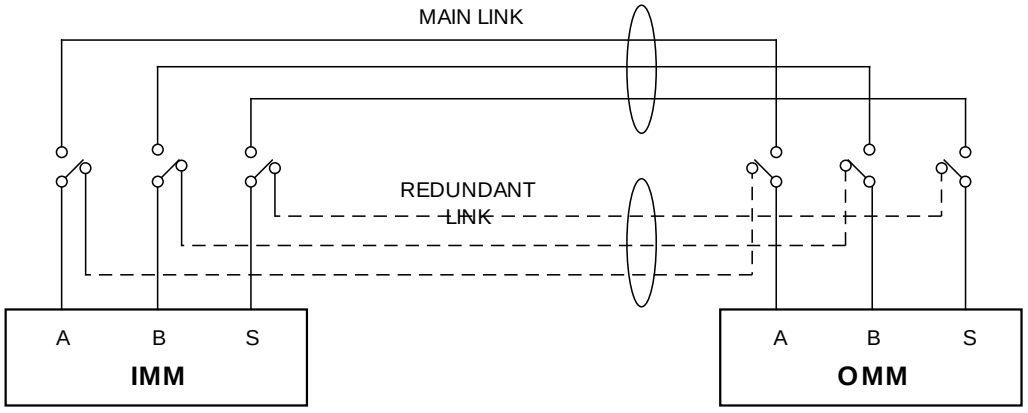


Figure 33. *Connecting an Automatically Switched Redundant Communications Link*

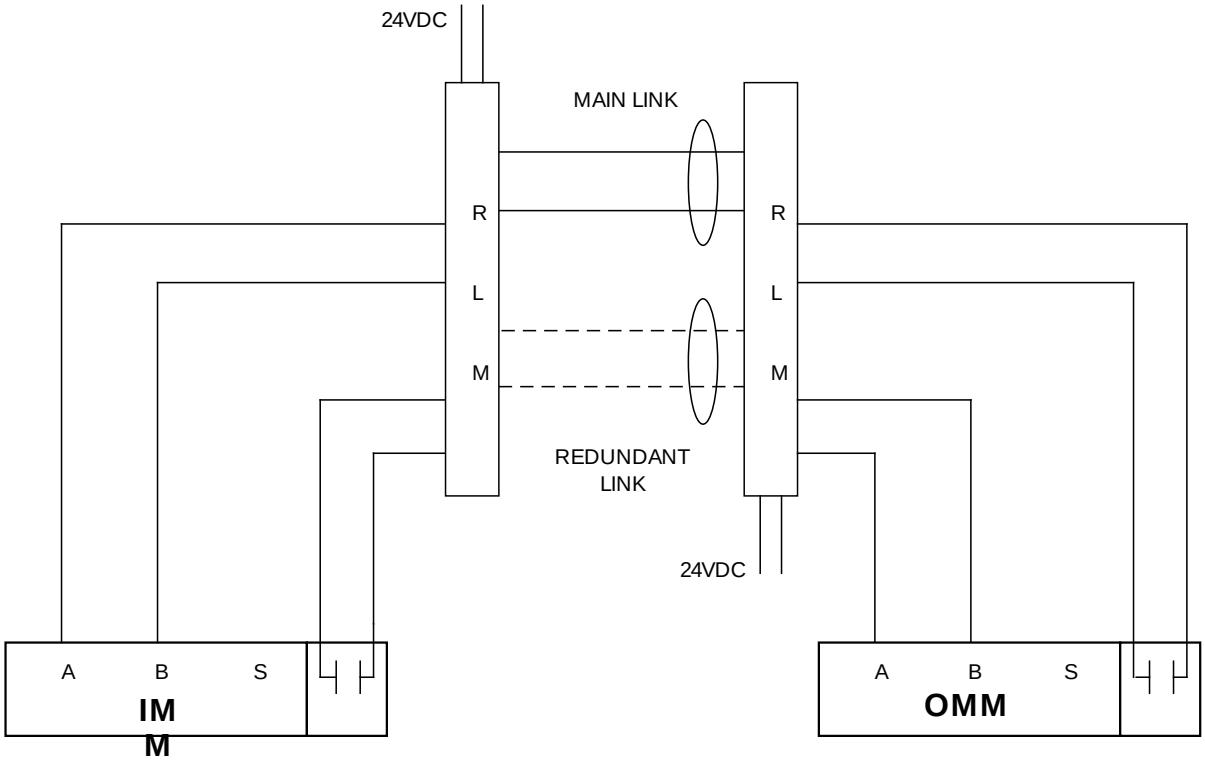


Figure 34. *Using a Single Manual Switch in a Redundant Communications Link (Not Recommended)*

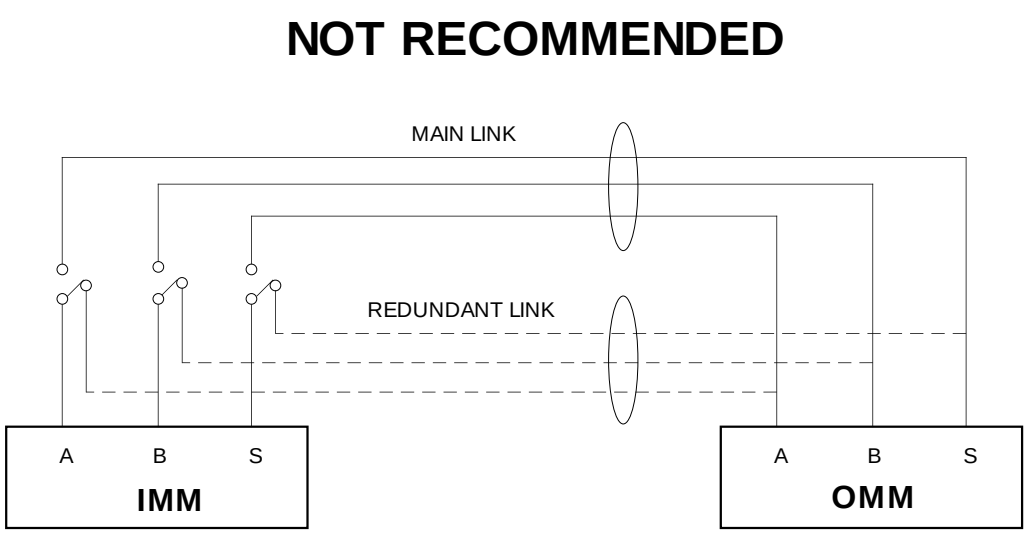
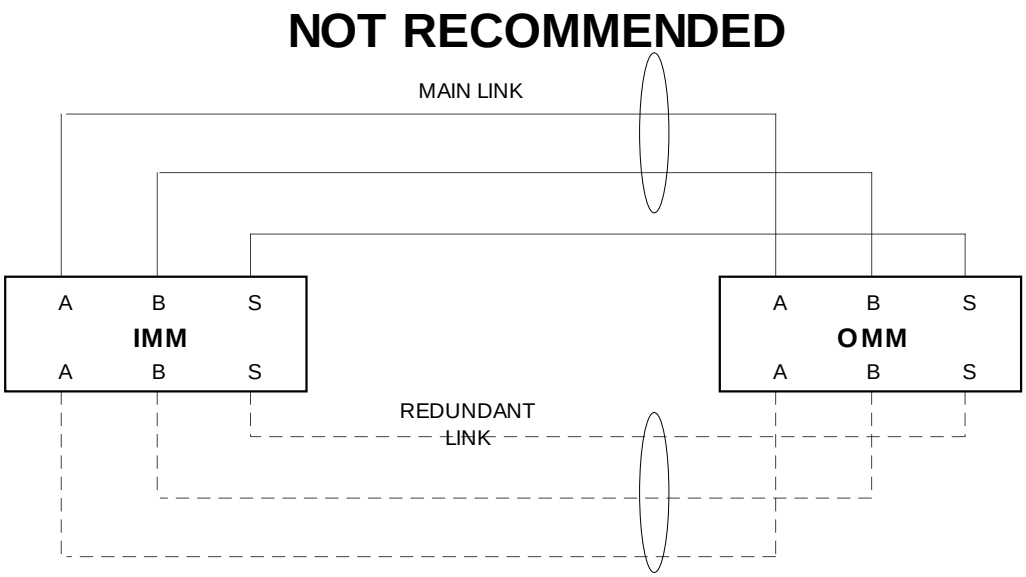


Figure 35. *Connecting a Redundant Communications Link (Not Recommended)*



NOTE: Comm link lengths must be within ±10% of each other

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Operation

Once installed, the CCS operates unattended. The System Menu displays on the IMM and OMM provide signal value/condition information for each channel used.

On power-up, all OMM outputs are initialized to zero or open, according to the hardware being used. The OMM then maintains zero or open until the first data message is received from its paired IMM. If a communication failure timeout occurs, the outputs are set to default values.

Range Limits. The range of default values that can be displayed for analog-configured channels is from **-5%** to **105%**. When actual values from the application exceed this range, the LCD will begin to flash the minimum (**-5%**) or maximum (**105%**), indicating under or over range, respectively.

Data Format for Modbus Units

IMMs and OMMs equipped with Modbus use a different data format. They use the 16-bit, signed, two's complement format with a data range of –32768 to +32767. When queried, a register will produce a two's complement number. Using a calculator, you can convert the two's complement to hex and then to decimal to obtain the value of the reading, representing percent of scale multiplied by 100.

The CCS data string follows this format:

s ddd dddd dddd dddd

s = Sign bit: 0 = positive; 1 = negative
d = data. The data is the binary equivalent in two's complement format of percent times 100 (% x 100). Data is clamped between: –5.00%(FE0CH) and +105.00%(2904H).

For example:

–1% = –(1x100) = –(100) = –(64H) = FF9CH

or

75.00% = 75x100 = 7500 = 1D4CH

For reference, the following is the data representation of the 16-bit, signed, two's complement format:

+32767	0	1111111	1111	1111	7FFF
.					
.					
+2	0	0000000	0000	0010	0002
+1	0	0000000	0000	0001	0001
0	0	0000000	0000	0000	0000
–1	1	1111111	1111	1111	FFFF
–2	1	1111111	1111	1110	FFFE
.					
.					
–32768	1	0000000	0000	0000	8000

Data Format for Discrete Channels

This is the data format for discrete channels (Registers 0-15) on Modbus equipped IMMs and OMMs:

dddd dddd dddd dddd

The bits are numbered in ascending order. The least significant bit represents channel one. The bit definition for OMMs and IMMs is different. For OMMs:

0 = OFF = LOW = Inactive

1 = ON = HIGH = Active

For IMMs:

1 = Contact Closure is ON

Troubleshooting

When an IMM or OMM is powered up, it runs a self-test routine. The display shows the following messages in succession:

(or some similar Module Type/Version Display)

If the diagnostic routine detects any system problems during the self-test, a warning appears on the display. The module cannot start until the problem is corrected. The messages state CONSULT MANUAL, and the user is advised to power down and power up again as this may solve the problem.

To verify the compatibility of this manual and your CCS Unit(s). After power up and the Self Diagnostic have completed, press ENTER. Listen for the tone that confirms instruction receipt. Disregard the status of the indicator LEDs. The LCD will show the Module Type/ Version display. For example:

Next, press ENTER once again. The display will return to the Channel Status Display.

NOTE:
This manual is for use with CCS modules using Moore Industries' Version 1.7 Universal or Discrete CCS firmware, Version 1.0 of the OMM firmware for Discrete modules with miniature power relays or the power relay pc board, and Version 1.0 for Modbus units. This firmware is available in Systems with serial numbers 707795 and above.

If the Module Type/Version display does not appear, you may have the wrong manual for the CCS. Contact your Sales Representative or the factory.

If the display shows the following in succession:

The CPU senses a low battery voltage from the RAM back-up battery and the user should consult the factory.

If the display shows the following in succession:

the diagnostic routine has sensed defective RAM and the user should recycle power to the System.

If the diagnostic again detects a defective RAM chip, consult the factory. In most cases, the unit will complete its diagnostic and return to normal operation.

If the display shows the following in succession:

The diagnostic routine senses a bad register. The user is advised to consult the factory.

If the display shows the following in succession:

The Communications, Configuration, and Channels Calibration data stored in RAM may have been corrupted. The user should recycle System power ***WITHOUT PRESSING ENTER.***

If the **DATA LOST** sequence appears again, it will be necessary to reset the operating parameters. Press ENTER, and set the module operating parameters according to your application, as described in this manual beginning with the Communications Setup section.

NOTE

When ENTER is pressed after the DATA LOST sequence, the module's operating parameters revert to the data loss default.

The data loss defaults are:

- SLAVE (IMMs)
- Unit ID = 1
- 4800 Baud
- Modem Option disabled (NO MODEM)-except for Modbus units
- Contact Closure input/output for all discrete-configured channels and modules.
- Current input/output (for Universal channels)

Refer to the System Specification sheet and Module Configuration Record to verify the factory default settings in the module being reset.

After reset, recycle power to the module. If problems persist, consult the factory.

Alarms

The "FAULT" LED alerts the user to a link failure or system level problem. The LED also flashes when a power interruption or non-volatile memory corruption occurs. Press ACK to stop the flashing of the "FAULT" LED. It will then emit a steady glow. On Modbus units, the "FAULT" LED does not flash, instead it glows steadily until the faults are acknowledged.

Along with the FAULT light flashing, the internal fault relay is activated when the communication link is lost. The fault relay is connected to the front panel so that external devices can monitor these conditions.

NOTE:

The time between communications loss and the FAULT light flashing and activating the fault relay is determined by the baud rate and the number of modules in the System.

Alarms are stored in an alarm log in each module. All alarms in the log can be viewed individually on the LCD. In Modbus units, the logs can also be viewed by querying Bits 0, 1, and 5 on register 32 with Command 03. Register 32 is defined in Table 9.

Table 9. *Defining Register 32*

Bit #	Read	Write	Command	Description
0	RD		03	Communication error (checksum/CRC, cleared when read?)
1	RD		03	Power was OFF
2	RD		03	
3	RD		03	
4	RD		03	
5	RD		03	Configuration data lost
6	RD		03	
7			03	
8		WR	06	Acknowledge fault conditions (Fault LED is glowing steadily. Set bit to acknowledge)
9		WR	06	Clear all alarms (Set bit to clear)
10			06	
11			06	
12			06	
13			06	
14			06	
15			06	

Note: Communication error is defined as five consecutive CRC errors.

Once an alarm is displayed, it can be erased from the log. The same is true for the entire log; it can be cleared and allowed to log future alarms. Modbus units do a write command 06 on Bit 9 of register 32 to clear all alarms.

Alarms are numbered in the log in the order of their occurrence. The first alarm is number “01”. The second alarm is number “02”. This process is continued up to the tenth alarm.

When the eleventh alarm occurs, the previous tenth is erased, and succeeding alarms are logged as number 10. Modbus equipped units can log up to 99 alarms but only 10 can be viewed. Multiple faults can be viewed on the front panel as they occur.

The display has a two digit field that identifies the number of each alarm presently stored in the log.

The display shows 10 alarm conditions, in order of their occurrence. If ten or fewer alarms have occurred since the last time the log was cleared, they can be viewed individually and are numbered 01 through 10. Should more than 10 alarms be logged, the display shows the first nine individually, and the last alarm registered is the tenth.

Modbus units log up to 99 alarm conditions. Multiple faults can be logged as they occur and viewed from the front panel. However, only 10 faults can be viewed. For example, if the CCS has logged 23 alarm conditions, then the log will reflect alarms 1-9 and number 23. Alarm 23 must be cleared to read Alarm 22 and each successive alarm must be cleared to read the previous one in the series. Reading holding register 32 will not indicate multiple occurences of the same fault condition.

The three alarm messages are displayed as follows:

After hardware faults, or momentary power failures, the display will show:

This fault does not activate the fault relay.

When power is restored after a power outage (including power-up), the display will show:

This fault does not activate the fault relay for non-Modbus units, but does activate the fault relay for units equipped with the Modbus option.

For communication link losses, the display will show:

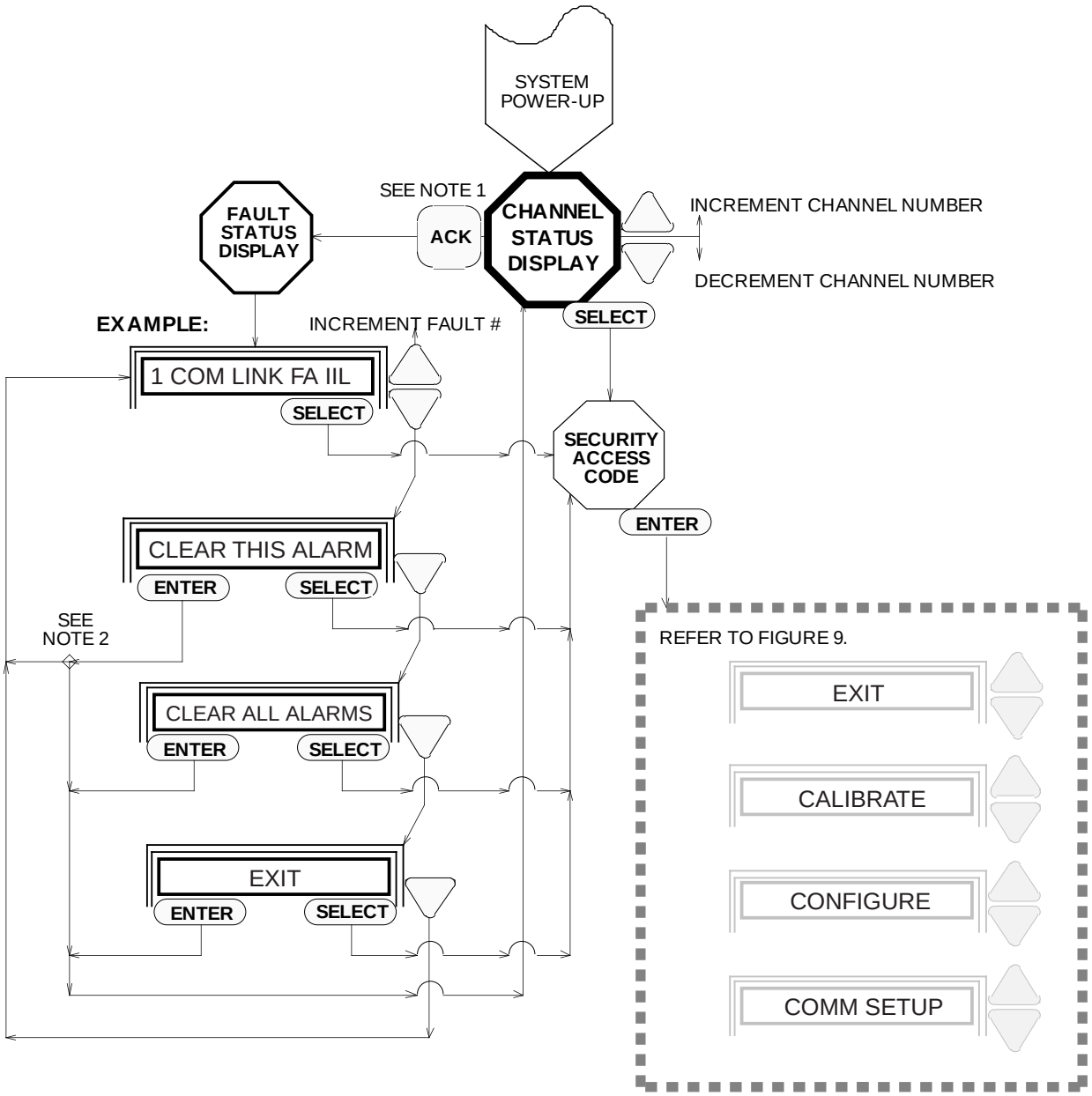
This alarm activates the fault relay in non-Modbus units. Should a communication link loss occur, the fault relay de-energizes. When the communication link is restored, the relay energizes within seconds.

When alarm conditions are remedied, the system resumes normal operations. However, the FAULT light continues flashing until the alarms are acknowledged by pressing ACK. On Modbus units, write command 06 to bit 8 of register 32 or press ACK to acknowledge the alarm to stop the steady glow of the FAULT light.

When an alarm is acknowledged, the FAULT light becomes constantly illuminated and an alarm message appears in the display.

Figure 36 shows the Fault menu.

Figure 36. *Accessing the CCS Fault Menu*



NOTES: 1. Menu accessed only if there are more FAULTS to clear.
2. If more FAULTS exist, accesses the next in the log; otherwise goes to Security Access Code Display.

Customer Support

Moore Industries is recognized as the industry leader in delivering top quality to its customers in products and services. We perform a battery of stringent quality asurance checks on every unit we ship. If any Moore Industries product fails to perform up to rated specifications, call us for help. Our highly skilled staff of trained technicians and engineers pride themselves on their ability to provide timely, accurate, and practical answers to your process instrumentation questions. Factory phone numbers are on the back cover.

If problems involve a particular CCS, there are several pieces of information you can gather ***before*** you call the factory that will help our staff get you answers more efficiently. When you call, please have:

- The model number of the unit in question.
- The serial number of the unit in question.
- The job number (if available).
- The purchase order under which the unit was shipped (if available).

Declaration of Conformity

EMC Directive 89/336/EEC

Manufacturer's Name: Moore Industries-International, Inc.
Manufacturer's Address: 16650 Schoenborn Street
North Hills, CA 91343-6196
USA

Declares that the product(s):

Product Name: **CCS**

	MODEL	/ INPUT	/ OUTPUT	/ POWER	/ OPTIONS	/ HOUSING
Model Number(s):	**IMM**	*	*	**18-30VDC**	**-CE[1]**	**[DIN]**
	OMM	*	*	**18-30VDC**	**-CE[1]**	**[DIN]**

*Indicates any input, output and option as stated in the product data sheet.

Conforms to the following EMC specifications:

EN61326-1, 1998, Electromagnetic Compatibility requirements for electrical equipment for control use.

Supplemental Information:

[1] RF filters are required for the –CE option.
[1] Additional measures are required to make relays options -NC and –NO CE compliant. Contact the factory for details.

January 11, 2005
Date

Fred Adt
Quality Assurance Director

Robert Stockham
Moore Industries-International, Inc.

European Contact: Your Local Moore Industries Sales and Service Office

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RETURN PROCEDURES

To return equipment to Moore Industries for repair, follow these four steps:

1. Call Moore Industries and request a Returned Material Authorization (RMA) number.

   Warranty Repair –
   If you are unsure if your unit is still under warranty, we can use the unit's serial number to verify the warranty status for you over the phone. Be sure to include the RMA number on all documentation.

   Non-Warranty Repair –
   If your unit is out of warranty, be prepared to give us a Purchase Order number when you call. In most cases, we will be able to quote you the repair costs at that time. The repair price you are quoted will be a "Not To Exceed" price, which means that the actual repair costs may be less than the quote. Be sure to include the RMA number on all documentation.

2. Provide us with the following documentation:
   a) A note listing the symptoms that indicate the unit needs repair
   b) Complete shipping information for return of the equipment after repair
   c) The name and phone number of the person to contact if questions arise at the factory

3. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.

4. Ship the equipment to the Moore Industries location nearest you.

The returned equipment will be inspected and tested at the factory. A Moore Industries representative will contact the person designated on your documentation if more information is needed. The repaired equipment, or its replacement, will be returned to you in accordance with the shipping instructions furnished in your documentation.

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RETURN POLICY

For a period of thirty-six (36) months from the date of shipment, and under normal conditions of use and service, Moore Industries ("The Company") will at its option replace, repair or refund the purchase price for any of its manufactured products found, upon return to the Company (transportation charges prepaid and otherwise in accordance with the return procedures established by The Company), to be defective in material or workmanship. This policy extends to the original Buyer only and not to Buyer's customers or the users of Buyer's products, unless Buyer is an engineering contractor in which case the policy shall extend to Buyer's immediate customer only. This policy shall not apply if the product has been subject to alteration, misuse, accident, neglect or improper application, installation, or operation. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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